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How Memphis Stacks up

JULY 1997

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Micron Executive™ desktop package
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Samsonite leather carrying case upgrade
2nd intelligent lithium-ion battery
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3GB primary hard drive upgrade
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32MB EDO RAM upgrade
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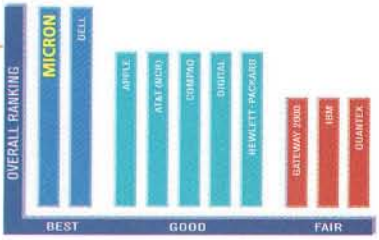

Source: *PC World* best overall PC company for reliability and service, December 1996.

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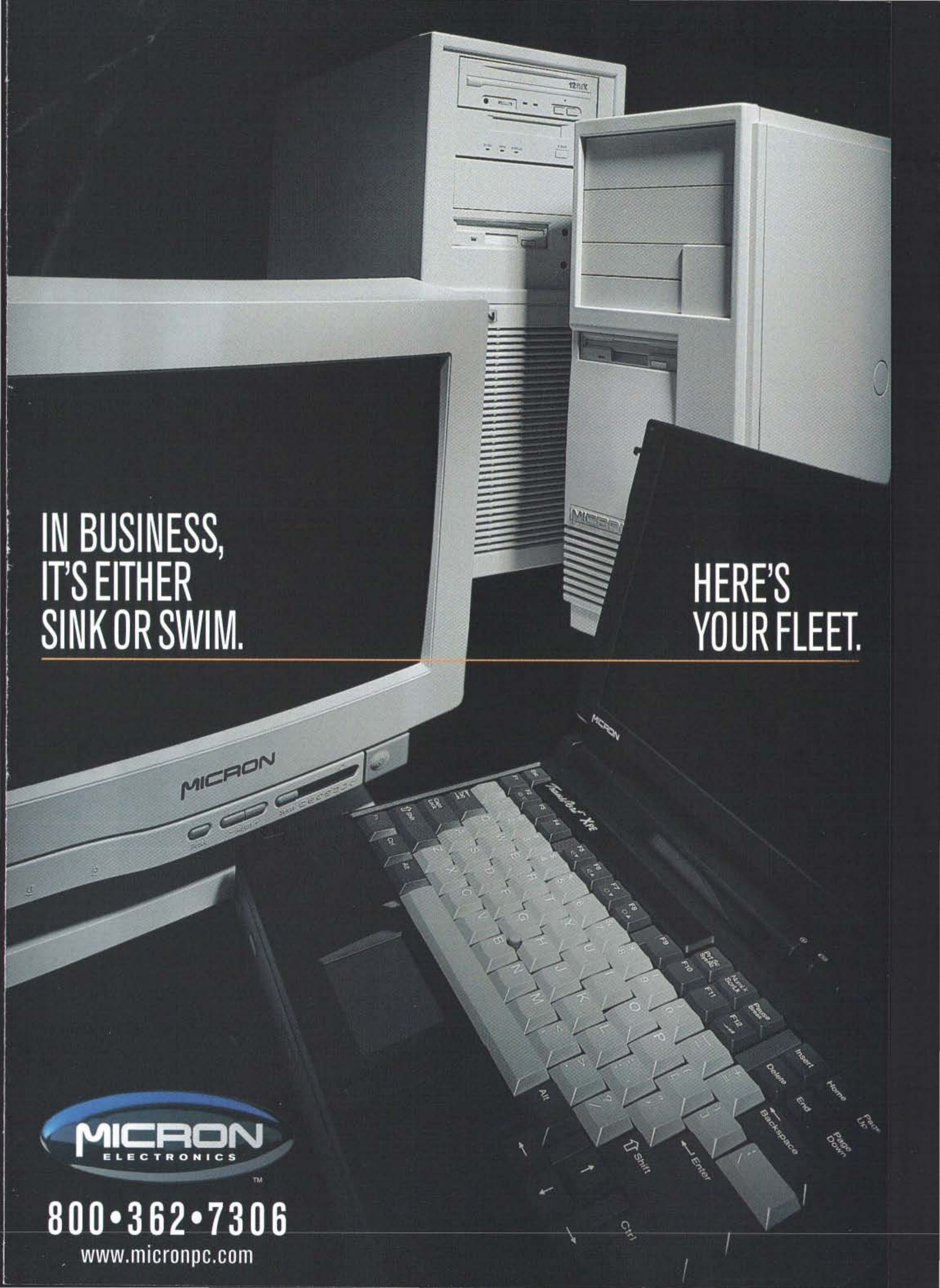
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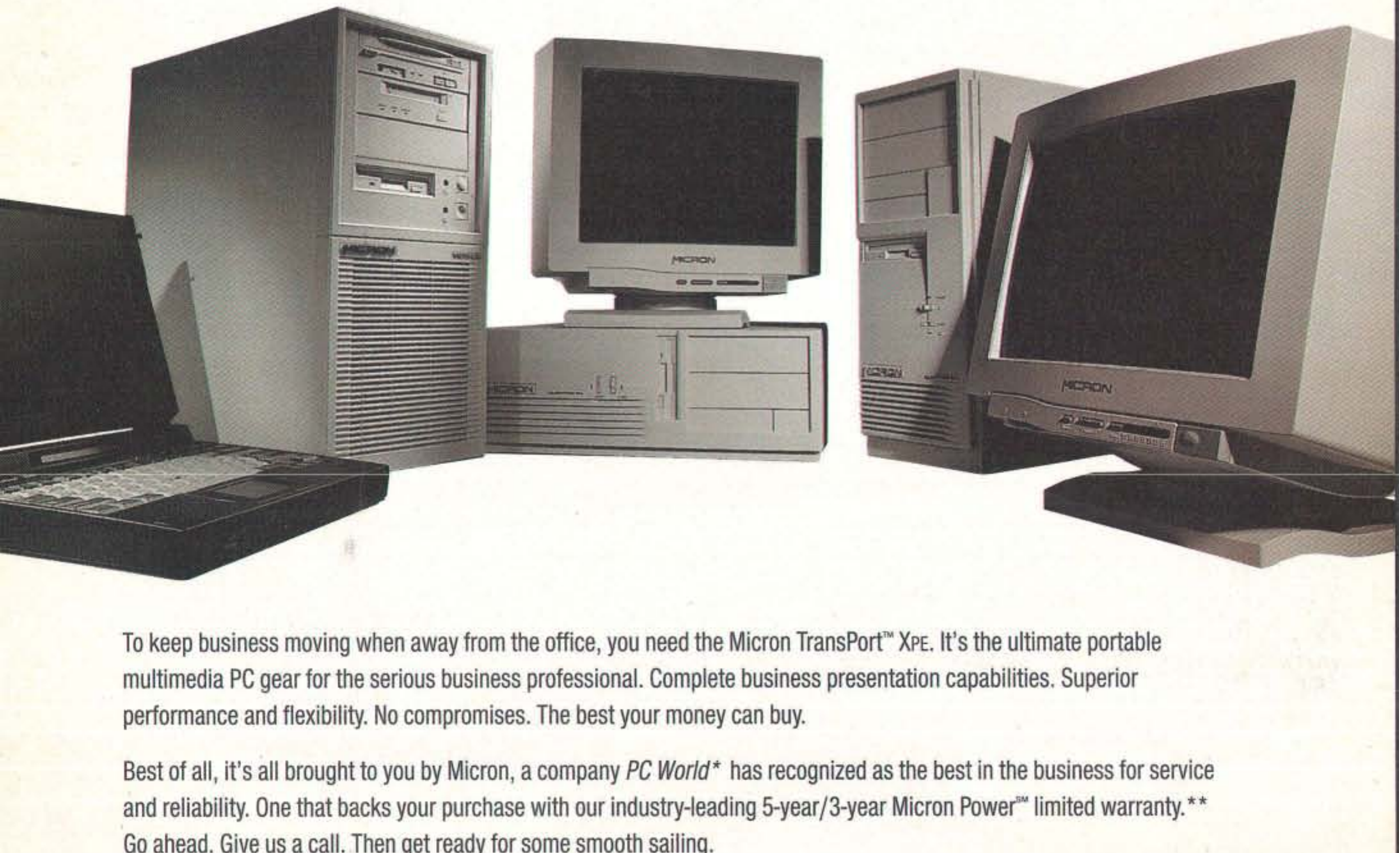

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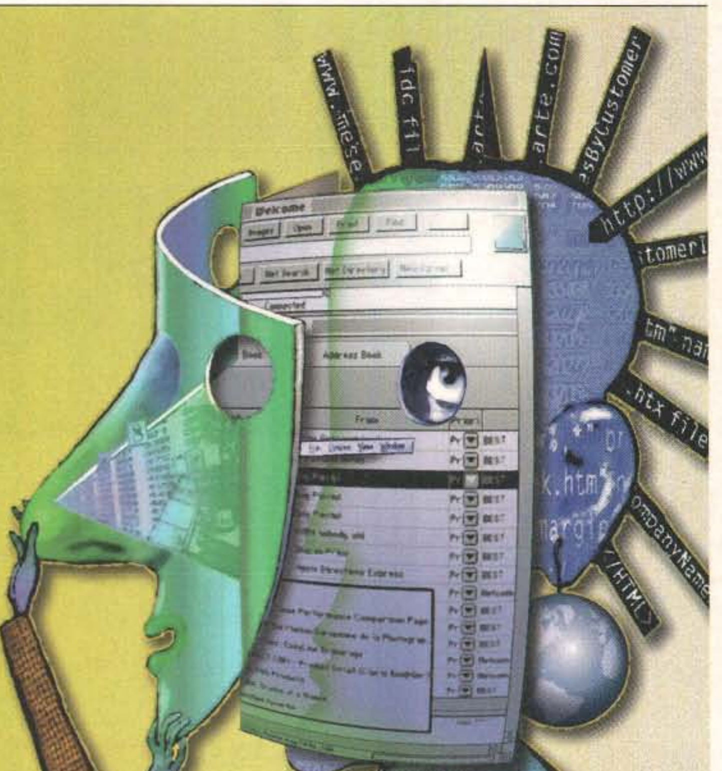

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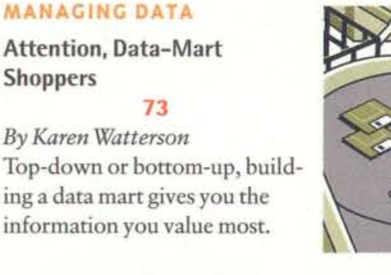

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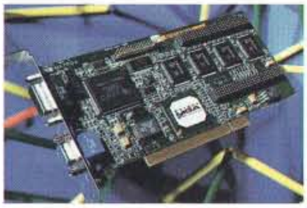

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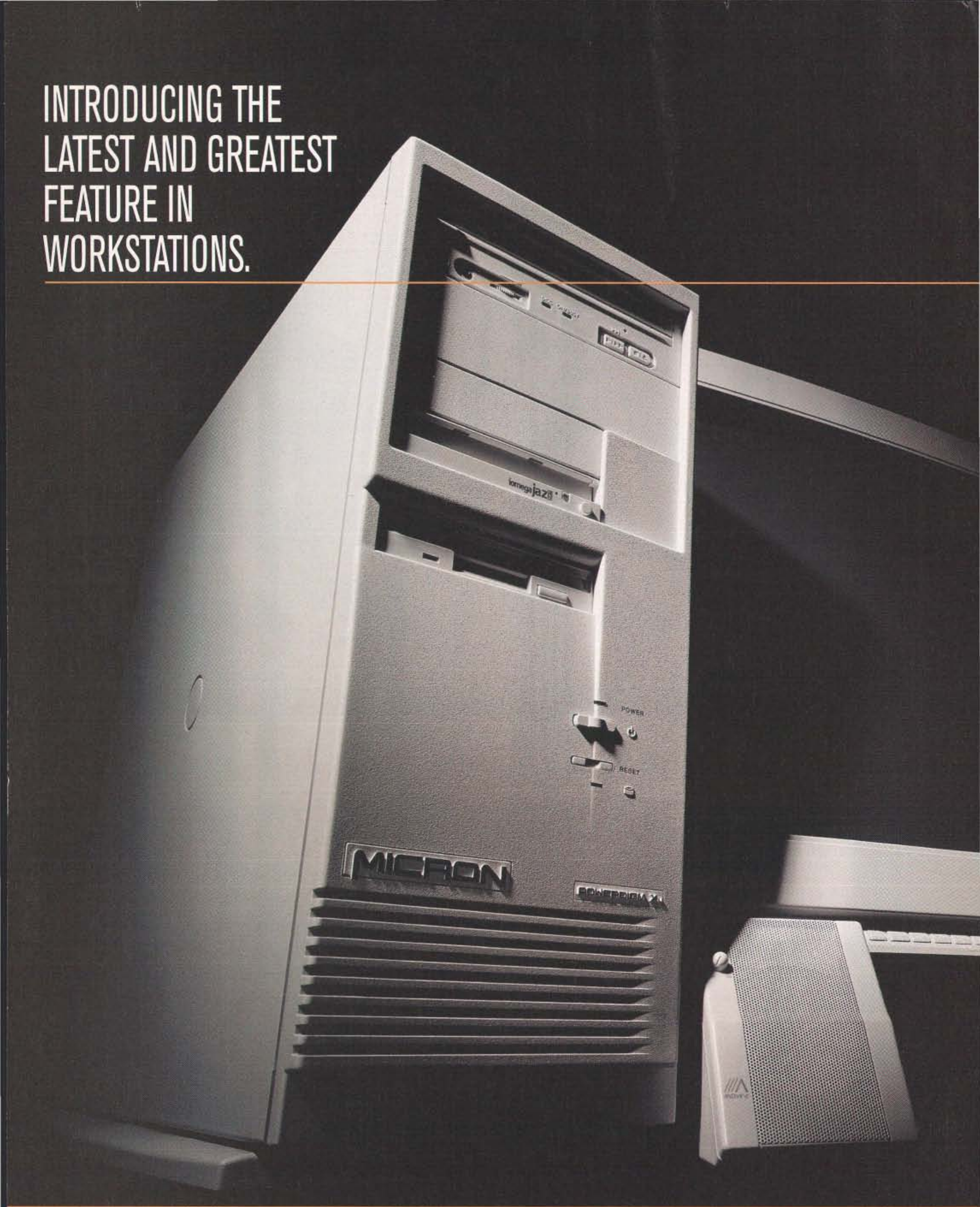
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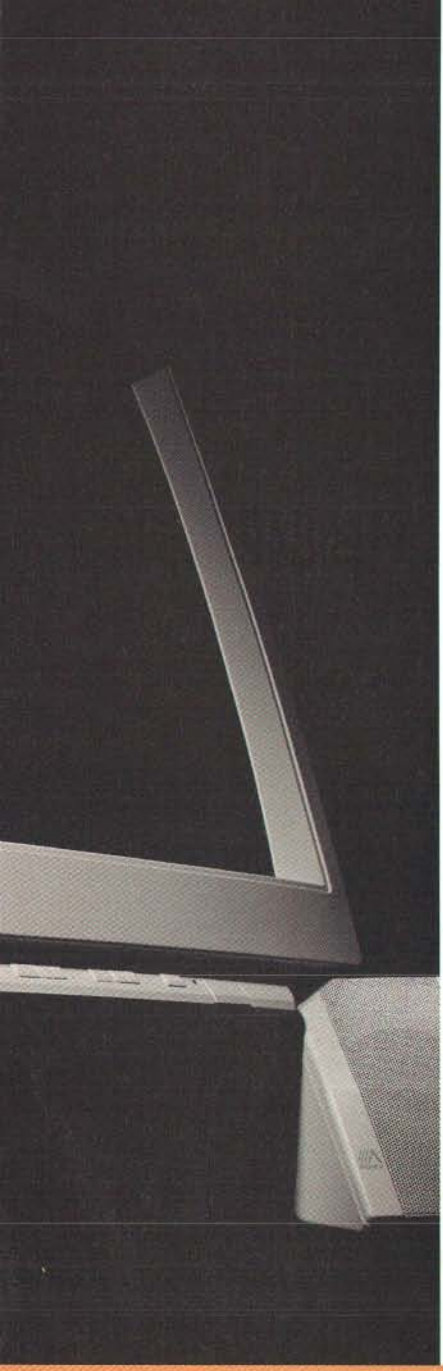

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Lexington, MA, 617-860-6294, ckilbourn@bix.com

EDITORIAL

EXECUTIVE EDITORS
International: Rich Friedman
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rfriedman@bix.com
New Media: Jon Udell
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MANAGING EDITOR
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WEST COAST BUREAU CHIEF
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NEWS
News Editor: David L. Andrews
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dave.news@bix.com
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REVIEWS
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FEATURES
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VICE PRESIDENT/PUBLISHER
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DOMESTIC AND INTERNATIONAL ADVERTISING STAFF
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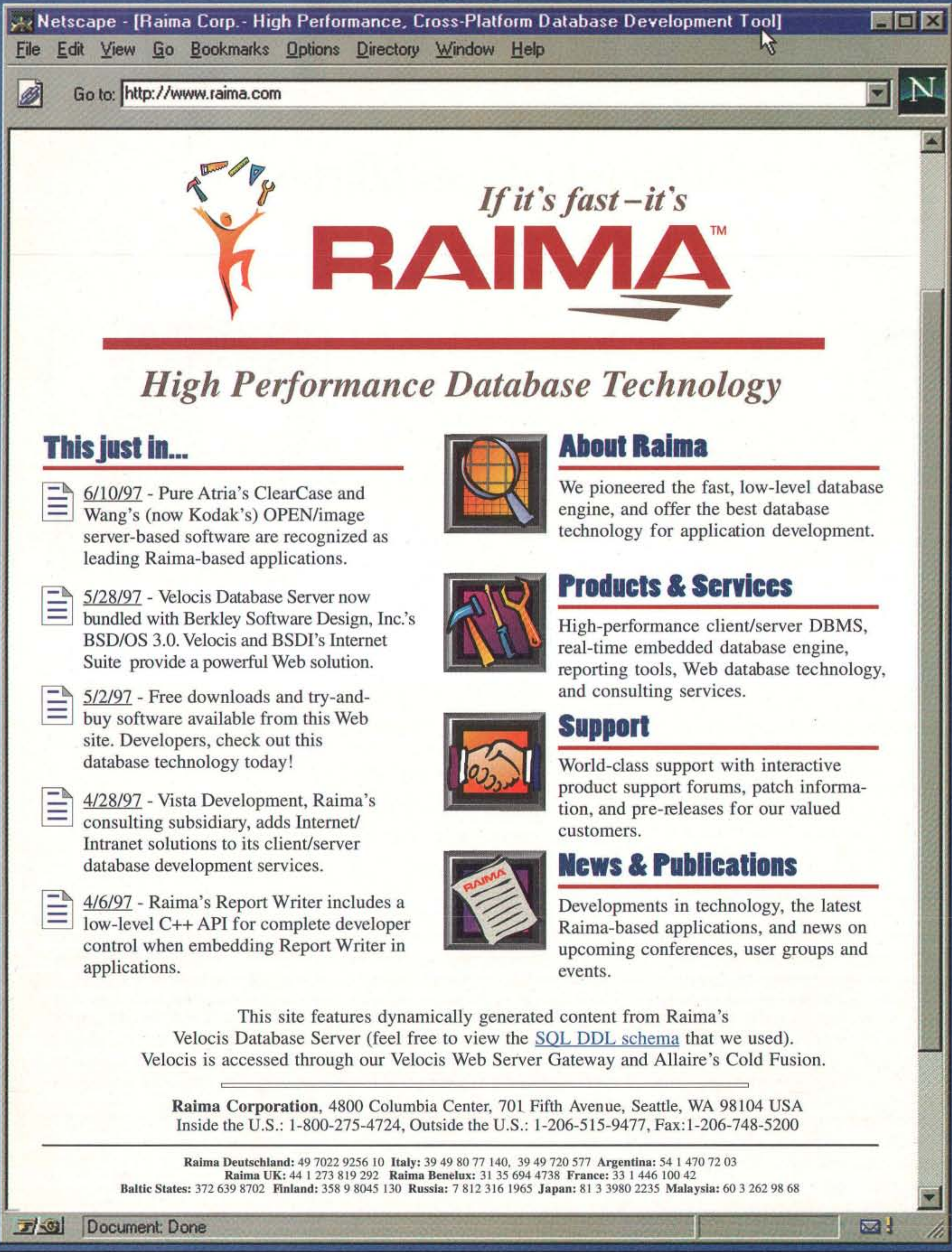
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editorial

Why Interfaces Matter

Looking for some good information?
Today's user interfaces may not help. That's why it's time for a change.

Computers are about to join the information age. Yeah, I know the computer created the information age. The invention of the steam engine may have started the industrial revolution, but electricity, the telephone, and the internal-combustion engine brought us to what we consider industrial society.

The user interfaces (UIs) we've had are the steam engines and telegraphs of computing. They were designed when all information resided on a disk drive on your computer. They're ill-adapted to a world in which you not only need to open a file, but access a database, look in your inbox, browse Web documents, and view a pushed channel. Each of these operations requires a different application, each with its own conventions. We need UIs that unite, instead of separate, all those modes. These interfaces are just arriving, as our Cover Story documents (p. 60). At first glance, they look like today's GUIs, but under the covers, much is different.

We dub this new generation of interfaces network user interfaces (NUIs). However, the shift is also about what travels through the network: Computing is becoming more information-centric.

My contention is that until now, GUIs have not been primarily about information, but about applications. For the last decade, our approach to computing has largely been, "Open a certain application to enter or manipulate some information and then produce the appropriate output." Was the information text? Use a word processor. Numbers? Use a spreadsheet. GUIs have been the way we accessed those applications.

This was certainly an advance over the prior UI, the command line, which in turn was an advance over its predecessor, a combination of punch cards and cables and toggle switches. Both those interfaces had a limited but important objective: Control the hardware. Think about the commands that DOS used: PRINT this, COPY that. The actual information being printed or copied was secondary.

Within the application-centric paradigm, software engineers began to craft a document-centric model. The application-control aspects of the interface would change as the user touched different kinds of content within one document. Some NUIs build on this notion, but the document-centric concept still misses the point. New interfaces need to accommodate information that isn't in documents and may be transient, such as live news or videoconferencing.

Sadly, the first generation of NUIs stops short of that goal. Some, for example, still open separate windows for separate functions, until your screen is cluttered with more windows than is useful.

The NUI will succeed or fail based on its ability to make it easy to navigate our complex information landscape.

The NUI won't end the proprietary data formats we use, but it creates pressure to use standard open ones such as HTML. So the first NUIs still won't enable a search that finds information whether it's in a proprietary .doc format, HTML, or e-mail—but they will create a platform on which to build that capability.

Nor will NUIs mean the end of discrete applications. To be really useful, NUIs will have to maintain links to legacy data. The radical net-computerists may want to start with a clean Web, but that's not likely to fly, anymore than halfhearted attempts to put a face-lift on today's cross-platform squirrel's nest. The NUI will succeed or fail based on its ability to make it easy to navigate our increasingly complex information landscape. That's a tall order, judging by the lengthy development cycles for both Microsoft Internet Explorer 4.0 and Netscape Communicator. But they and their ilk are an important start.

The ability to combine live content with active content that integrates data and interactive logic with our entire storehouse of data is probably the next step in the information age. It won't be the end of that path—someday we'll get the kind of machine intelligence and human-interface computing that places such as MIT's Media Lab are already developing—but it's a huge improvement over what we have now, even if the icons still look the same.

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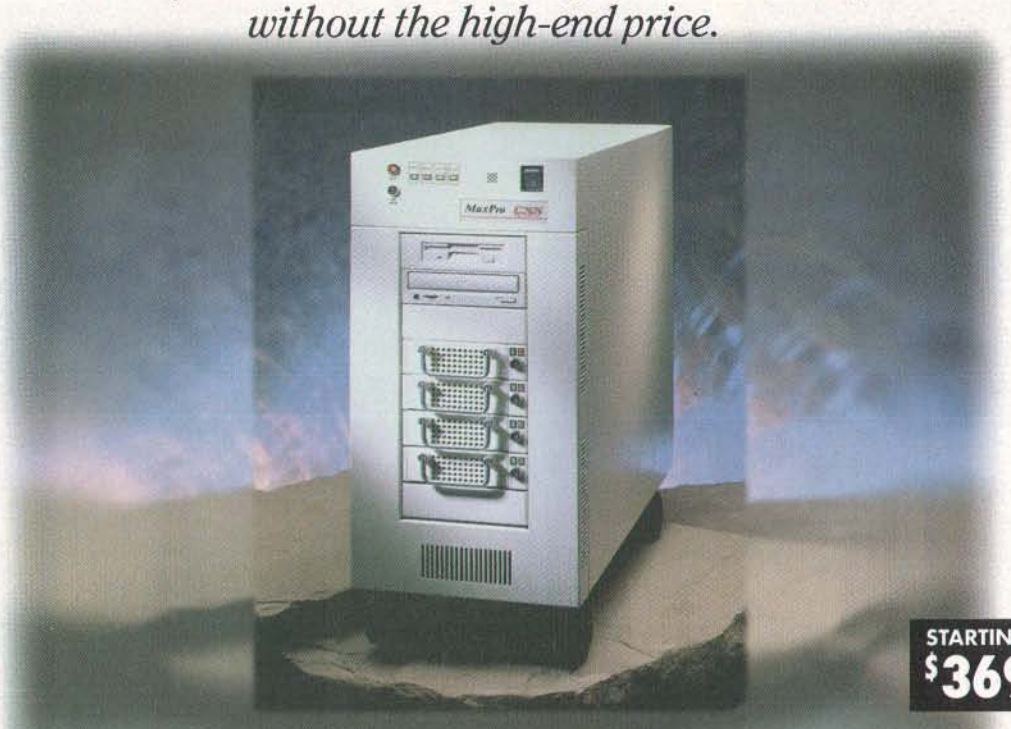

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inbox

Definitive Article

Thanks for what must be the definitive article on network computers (NCs) ("Cheaper Computing," April). I found Tom R. Halfhill's unbiased coverage to be both broad and sufficiently deep to give an excellent understanding of what's currently happening and what's going to happen with the NC market.

Leigh S. Power
powerl@guinness3.team400.ie

Real Statistics

"Cheaper Computing" was an excellent tutorial on the NC-versus-PC debates. In it, Tom R. Halfhill says that the only argument against the NC that holds water is its network dependency. I have just run a detailed analysis of 805 help-desk calls for one day's worth of activity on an exceedingly well-run network. Only four of those calls could be classified as "communications" failures. The rest were mostly operator errors (such as failed logons, printers that didn't work, and wires that got kicked). I wonder whether you have access to statistics about what really happens on networks. It's not the technology that costs; it's people.

Paul Strassmann
paul@strassmann.com

If by "communications failures" you mean network problems, and if your results are typical for most networks, then the argument that NCs are too network dependent may not be such a good one. Besides, as I said in the story, applications are becoming network-centric, so PCs are not immune to network problems, either. Another way to look at it is that NCs are not the cause of network dependency; rather, increased network-centricity is causing NCs.

Statistics aside, I think the biggest problem with today's PCs is persistent storage, especially the intermingling of system software, applications software, and user files on the same storage device. When you consider that users are not only allowed, but often required, to tinker with their system software—and that any program's installer can also modify the system software—it's a wonder PCs work at all. NCs, as stateless devices, avoid the problems associated with persistent storage. Over time, I think PCs will address this issue more directly.
—Tom R. Halfhill, senior editor

Intranet Servers

The performance numbers shown in Robert L. Hummel's "Multiprocessor Intranet Servers" (May) were very informative in regard to how Unix and NT perform side by side in a static environment. The article also raised some good points about performance, price, and reliability. But it failed to address the most important issues: availability and performance based on future scalability.

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For the moment, most major Unix vendors have the advantage in that they can handle many more processors (Sun's UltraEnterprise 10000, for instance, scales to 64 processors) and more than two symmetric multiprocessing (SMP) or massively parallel processing (MPP) nodes.

NT's current inability to scale based on load management impedes an NT server's ability to maintain availability as concurrent user loads increase. Of course, Microsoft and server vendors are making amazing headway into the area of scalability, but organizations looking at massive growth should be aware of this.

Andrew Gup
Spectra Logic Corp.
AndrewG@spectralogic.com

Setting up a complete server system is too complex an issue to address comprehensively in eight magazine pages. Also, it's difficult to pronounce a specific performance or configuration item as the "most important" one. A significant part of the market has responded to this classic Unix protest by saying, "We don't care. NT boxes are less expensive, easier to configure, and easier to expand, and they don't lock us into a single-vendor hardware solution or become obsolete when the vendor wants a new revenue stream. Unix administrators are also harder to find."
—Robert L. Hummel

Bring On the Alpha Clones

I've seen way too many comparisons between a number of x86-based systems from different vendors and an

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Alpha-based system from Digital Equipment. The comparisons show that Alpha systems from Digital offer the same (or less) bang for the buck than x86-based machines.

But what about the Alpha clones? There are vendors (e.g., Aspen Systems, http://www.aspsys.com/) who sell multiprocessor Alpha systems at a lower cost than Digital's single-processor systems. I would like to see how these Alpha-clone solutions stack up against the x86 systems in price/performance. I think it'll be an eye-opener.

Bryan J. Smith
Systems engineer
Coleman Research Corp.
b.j.smith@ieee.org

We are not unaware of Alpha clones; for example, we have reviewed Polywell's Alpha-based systems in past issues and would have included one in our May Lab Report on intranet servers if last-minute technical problems hadn't intervened.
—David Essex, director of reviews

Capitalizing on Dfs

I have been observing the developments of Microsoft's initiative to achieve "Zero Administration for Windows" ("PCs Strike Back," May). One of the biggest problems that Windows administrators face is software distribution. On Unix machines, this is achieved by installing a package on an NFS file system and letting everyone use it. This just isn't feasible in a Windows/NT environment because most Windows programs must install some files under C:\WINDOWS. If this bottleneck is fixed, software installation (i.e., distribution) on Microsoft platforms can be as good as it is on Unix and truly capitalize on the Distributed File System (Dfs).

Satyam Bheemarasetti
Senior distributed systems consultant
Lark Systems
satyam@poboxes.com

There is definitely merit to this idea, although there might be advantages to storing some files on local disks, including better performance and the ability to do some functions even if the server is down. I say "might" because the fact that some files are stored locally doesn't necessarily guarantee either of these results.
—Mike Hurwicz

Latin-X

Although I praise the increasing use of Unicode (and its UTF-8 form) ("Unicode Evolves," March), I would caution against prematurely dropping support for the primary 8-bit character sets. In particular, failing to support all six of the bandwidth-friendly MIME-standard ISO 8859 Roman code pages (Latin-1 [Western], -2 [central European], -3 [Esperanto], -4 [Baltic], -5 [Turkish], and -6 [extended Baltic]) would open applications providers to accusations of Internet censorship and gagging of linguistic diversity. I look forward to e-mail and browsers implementing Unicode, but hope they won't continue to suppress the netizen's ability to read messages and Web pages in Latin -2 to -6.

Aaron Irvine
Belfast, Northern Ireland

Unicode in all forms (UCS-2, UTF-8, and so on) contains those characters, so a browser or mail client can continue to handle those languages either through 1:1 mapping—that data can be converted in both directions between ISO 8859-x and Unicode/ISO 10646—or directly through Unicode, since it is a superset and includes all the required characters. Unicode actually helps these languages because you no longer have to switch code pages to move between those characters. In the past, the software industry often defaulted to the requirements of the largest installed base, at the expense of other languages.
—Ken Fowles

Wrong Key, Part II

In May's Inbox, Thomas Paul Karrmann, commenting on "Your E-Mail Is Obsolete" (February), and author Michael Nadeau agreed on the difficulty of encrypting messages for multiple recipients.

Pretty Good Privacy (PGP) allows you to do this simply—with minimal increase in the message size. PGP uses the public-/private-key protocol only for key management and digital-signature verification. The message itself is encrypted using the International Data Encryption Algorithm (IDEA). PGP creates a random key for the "session" (i.e., the message) and uses the public-key protocol to encrypt that session key for each recipient. This collection of encrypted keys forms a control block for the whole message. Recipients use their private keys to decrypt their portion of the control block, which contains a copy of the session key. For additional details about this increasingly vital field, see *Applied Cryptography, Second Edition* by Bruce Schneier (John Wiley & Sons, 1996).

Jim Dennis
Proprietor
Starshine Technical Services
jimd@starshine.org>

Thanks for pointing that out. See also Internet RFCs 1421 through 1424 (consult the Internic RFC Index at http://ds.internic.net/ds/rfc-index.1400-1499.html for links), which describe the Internet Privacy Enhanced Mail (PEM) standards.—Eds.

Staying Put

I'm having trouble assigning the drive letter for my Iomega Zip drive. It always wants to be E. My OS is Windows NT 4.0.

Antonius Arif Octovian
Arif@myself.com

You are not alone. Jerry Pournelle has described similar problems with Windows 95 in his column, and this topic has also been a prominent subject in one of our online conferences. Check out news://dev4.byte.com/syscon for lots of discussion and some suggestions.—Eds.

FIXES

In the table "A Variety of NT-to-Unix Solutions," which accompanied the Datapro Report in the May Bits, the telephone number we printed for Datafocus is no longer current; the correct number is 703-803-3343.

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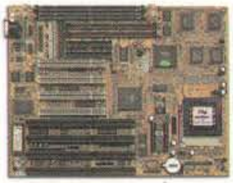

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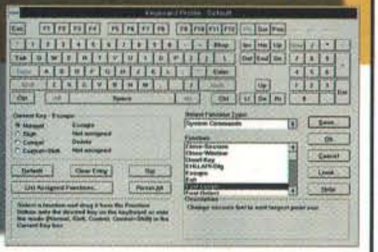

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In the features table on page 114 of the May issue, in the Hardware Lab Report "Multiprocessor Intranet Servers," we erroneously specified the amounts of test-system and standard-system RAM in kilobytes; we meant megabytes.

In the text box "System Requirements for NetPC" in "PCs Strike Back" (May), we indicated that 8 bytes per pixel was one of the requirements for display-adapter minimum resolution; we should have said 8 bits per pixel.

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HARDWARE LAB REPORT

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- Ensoniq™ 3D Wavetable Card plus Amp, Speakers & Mic
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- 17sd69 Monitor (16.0"viewable)

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First 300-MHz Pentium II Results

Intel's latest Pentium II processor breaks the 300-MHz x86 speed barrier.

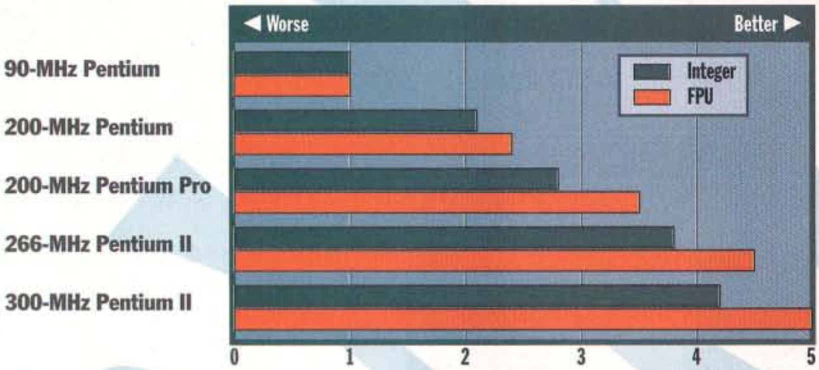
Our tests of a 300-MHz Pentium II-based PC peg the latest Intel processor's performance at just about where you'd expect it, compared to the previous high end of Intel's x86 line, the 266-MHz Pentium II. The 300-MHz Pentium II system we tested posted 4.24 on the BYTEmark integer tests and 5.0 on the BYTEmark FPU tests, compared to 3.8 and 4.5 for a 266-MHz system.

BYTE was able to get access for a couple hours to a precommercial Tyan Tahoe 2 ATX dual-processor motherboard equipped with the 300-MHz CPU (the secondary L2 cache bus runs at 150 MHz, while the system bus runs at 66 MHz). Unfortunately, we didn't have time to run our cross-platform Photoshop test suite on the system.

Officials at Tyan (408-956-8000; http://www.tyan.com), which makes the Tahoe and other motherboards that support Intel's latest Pentium II, say that tweaks to the Tahoe's design should improve performance by another 3 to 5 percent. However, running the BYTEmark and Bapco Sysmark for NT 4.0 benchmarks showed performance that scaled as expected, compared to slower Pentium IIs. Systems that have the 300-MHz version of the Pentium II should be available in quantity early this summer.

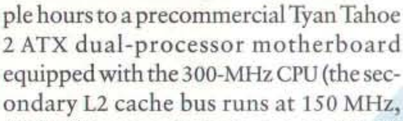
– Dave Andrews

High Five for 300-MHz Pentium II



BYTEmarks measure raw CPU power and do not measure overall system performance.

Applications Go Faster at 300



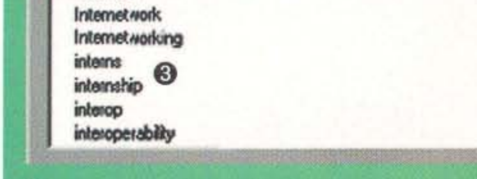
Bapco's Sysmark for NT 4 measures overall system performance. The 266-MHz system had 64 MB of RAM, Diamond Multimedia Stealth 3D 2000 (4 MB of RAM, 1024 by 768, 24-bit resolution), and Maxtor 85120A EIDE hard drive. 300-MHz system had 32 MB of RAM, Matrox Millennium (2-MB WRAM, 1024 by 768, 16-bit resolution), and Quantum Atlas II Ultra SCSI-3 drive.

Speak Naturally

For years, the computer industry and hunt-and-peck typists have awaited the day when people could use a general-purpose voice-recognition system to talk to their PCs without having to pause between words. Much to the joy of data entry operators, secretaries, people with disabilities, and busy executives, that day has apparently arrived.

NaturallySpeaking, a new program from Dragon Systems (617-965-5200; http://www.naturalspeech.com), represents the first generation of continuous-speech dictation systems for Win 95 and NT. With NaturallySpeaking, the company says, you do not have to pause between words while dictating documents or issuing commands to your computer.

Like many voice-recognition packages, NaturallySpeaking is still speaker-dependent: It requires you to train the software to accurately recognize your voice. Officials at Dragon wouldn't reveal exactly what techniques they used to accomplish the continuous-dictation capability other than to say NaturallySpeaking uses a



Written form:
Internet Service Provider
Spoken form (if diff
ISP

Written form	Spoken form
internet	
Internet	
+ Internet Service Provider	ISP
Internet's	
Internetwork	
Internetworking	
interns	
internship	
interop	
interoperability	

❶ The pronunciation for new words is automatically created.

❷ The "+" indicates a new word.

❸ Access the entire 200,000+ word dictionary.

new speech-recognition engine to deliver improved performance.

Though NaturallySpeaking appears to have the lead in this race, Dragon's competitors say they, too, will soon have products with similar recognition capabilities. "Everybody's going to take this step soon," says Mark Flanagan, vice president and general manager at Kurzweil Applied Intelligence, another major player in the speech-recognition arena. "From what we've seen, Dragon has made a legitimate move toward continuous dictation. But they've announced essentially alpha software. How long will it take to translate to an acceptable product?" Dragon says the first versions of the new product will ship by the end of June, at prices starting at $695.

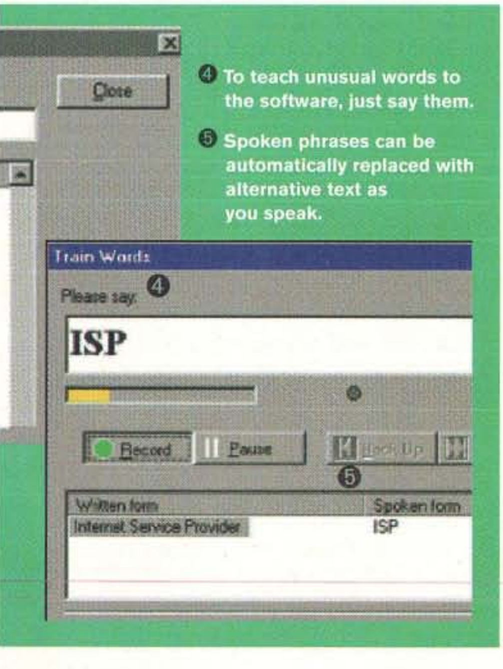
NaturallySpeaking requires at least a 133-MHz Pentium processor, and the program is faster on MMX machines. The software needs 32 MB of RAM under Win 95, 48 MB under NT 3.51 and 4.0, and 60 MB of free hard disk space. NaturallySpeaking also requires a standard 16-bit sound card or built-in sound system on portables. It comes bundled with a headset-style microphone. The program has a 30,000-word active vocabulary that is memory-resident and a 200,000-word backup dictionary on disk.

Having continuous recognition for general use on the Win 95 platform appears to be a first, but it should be pointed out that other continuous-dictation products for specialized use in vertical markets are already available. "IBM has had a continuous-speech product since 1996 called MedSpeak, aimed at the radiology market," says Susan Scott-Ker, a spokeswoman for IBM speech systems. "But MedSpeak's 25,000-word dictionary is customized for a specific application, whereas NaturallySpeaking is for daily use in a business or home environment. We're using the information gained from MedSpeak on a more general product, which will be released later this year."

IBM officials recently introduced a Chinese continuous-speech system in Beijing and Hong Kong, but the company's showing of the software was a technology demonstration only. A spokesman said IBM will announce price, shipping date, and other details later this year. Motorola says the first products based on its Chinese-language continuous-speech system may ship by the end of '97. Kurzweil officials hint that their company might offer general-purpose continuous-dictation technology by the end of the year.

If NaturallySpeaking works as Dragon claims (look for a review in an upcoming issue), it will represent an important step in making technology that's an alternative to keyboard input available to a wider audience. As computers get more powerful, memory prices drop, and sound cards and speech-enabled applications become commonplace, voice-recognition systems will start to move into the computing mainstream.

– Joe Lazzaro



ISP

Written form	Spoken form
Internet Service Provider	ISP

④ To teach unusual words to the software, just say them.

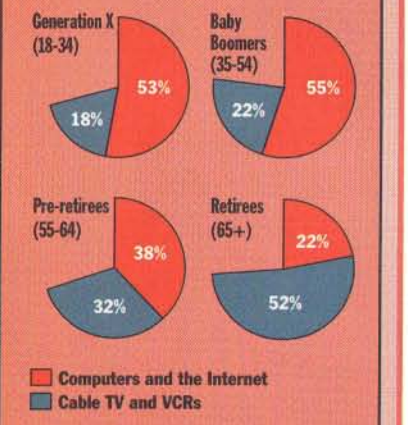
⑤ Spoken phrases can be automatically replaced with alternative text as you speak.

Geek Mystique

Impact Wars: PC vs. TV vs. Car

Most Americans seem to rate the computer as more important than the TV but less important than the automobile, according to a recent poll. In a survey conducted earlier this year by the Luntz Research Companies, when asked whether their car or computer will be more important in their life in the year 2007, 55 percent of respondents said the car, 41 percent said the computer, and 4 percent didn't know or refused to answer. In another question, three of four generations of Americans said computers and networking have had more impact as technological developments in the past 20 years than TV (see the chart for more info). Only retirees felt that cable TV and VCRs have had more impact.

Which Technology Has Had the Greatest Impact?



Source: Luntz Research Companies; 703-358-0080

Hot Plug Will Deliver Higher Availability

A new technology will let PC server administrators expand, upgrade, or replace PCI adapter cards without having to power-down the system. The new standard, PCI Hot Plug Specification, should be final by late spring, and the first hardware that supports the new PCI Hot Plug spec should be available early in the second half of this

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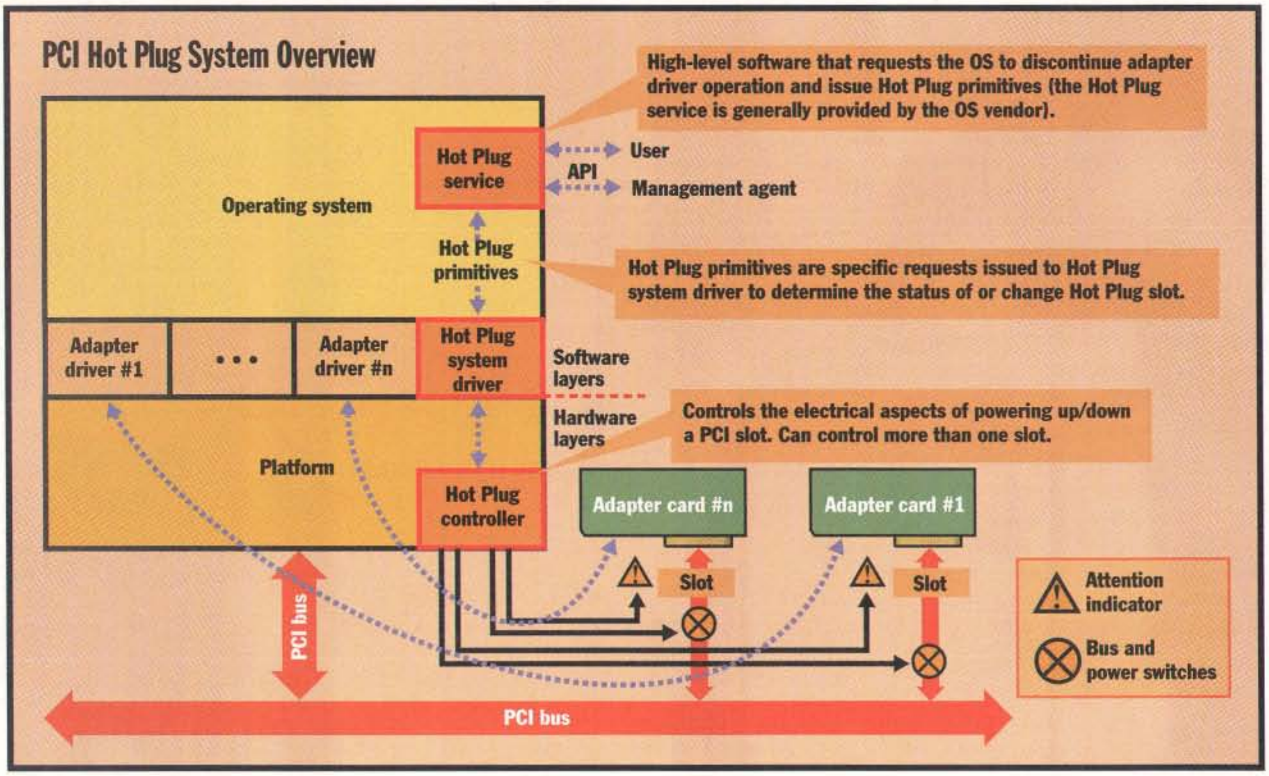


PCI Hot Plug System Overview

High-level software that requests the OS to discontinue adapter driver operation and issue Hot Plug primitives (the Hot Plug service is generally provided by the OS vendor).
Operating system
Hot Plug service
API
User
Management agent
Hot Plug primitives
Hot Plug primitives are specific requests issued to Hot Plug system driver to determine the status of or change Hot Plug slot.
Adapter driver #1
• • •
Adapter driver #n
Hot Plug system driver
Software layers
Hardware layers
Controls the electrical aspects of powering up/down a PCI slot. Can control more than one slot.
Platform
Hot Plug controller
Adapter card #n
Adapter card #1
Slot
Slot
PCI bus
PCI bus
Attention indicator
Bus and power switches

year. However, users will also have to wait for Microsoft, Novell, and SCO to upgrade their operating systems to support the new spec. These three vendors all plan to support Hot Plug with upgrades to their system software throughout the year.

The new spec is designed to make PC servers better platforms for running business-critical applications without interruption. Hot Plug PCI comes in three flavors, but all share the common attribute that they don't make you turn off your server when you need to replace or upgrade devices. Those flavors are: Hot Plug PCI Replacement (replace a failed or expected-to-fail device with an identical device); Hot PCI Upgrade (replace existing PCI devices and drivers with new versions); and Hot PCI Expansion (install additional I/O cards and driver software).

The burden for moving to Hot Plug is placed on the platform vendors, such as PC server and OS vendors, says Karl Walker, director of technology development at Compaq's enterprise computing group. (Compaq is a major supporter of the Hot Plug initiative and plans to release compliant hardware early in the second half of '97.) The objective is to let people use their current PCI adapters, but with new servers and OS updates to enable Hot Plug. Hot Plug will require new drivers and changes to the OS (see the figure above). Also, compliant servers will need additions to their motherboards, such as a Hot Plug controller, and slot-specific power switches to let software remove power from a slot while the rest of the system is running. And servers will need to be built so that end users can easily get access to PCI adapter cards without disrupting the PC's operation.

PCI is not a fault-tolerant bus, so if a PCI card dies and compromises the integrity of the PCI bus or software system, the server will still need to be restarted. But Hot Plug technology does

Future Watch

Thin Is (Soon) In (NT)

The Windows environment is usually associated with "fat client" computing, but it looks like thin will be in, as in in NT. In a speech delivered at the recent Windows Hardware Engineering Conference in San Francisco, Microsoft head Bill Gates acknowledged that the company is taking a hard look at Windows terminals. Customers want a thin client that is very simple, Gates said. And, he noted, putting a Web browser and operating system in a "true thin client" is a contradiction in terms.

At the time, what Gates hinted at sounded dangerously close to describing Citrix's WinFrame, which lets a network of clients run programs that reside on an NT server. In fact, Microsoft and Citrix have since announced a cross-licensing agreement in which Microsoft will use Citrix technology to add support for Windows terminals to a future version of NT. Microsoft says it will integrate thin terminal support into NT 5 and will retrofit it into NT 4 but won't say when until later this summer.

WinFrame clients are available for DOS, Windows, OS/2, the Mac, and different versions of Unix. Citrix's Intelligent Console Architecture intercepts Graphical Device Interface (GDI) calls and redirects them to the client. The client thus receives graphical representations of the applications that are executing remotely on the server; the client machine does not actually execute Windows or Windows applications itself.

– Dave Andrews

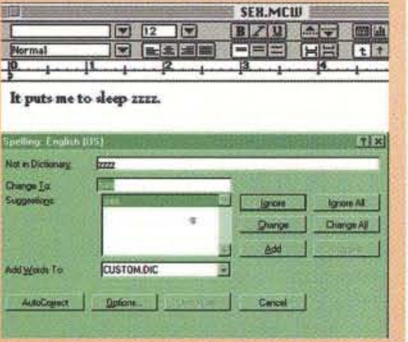
promise to alleviate server downtime due to bad PCI cards or upgrades. And this will allow for more robust PC servers to run critical applications without interruption.

– Dave Andrews

Bug of the Month

Substitute Sex for Sleep

Is sex a good substitute for sleep? BYTE reader Dilip Sampath Kumar reports that when using Microsoft Word 7.0 to spell-check a document that had the nonword "zzzz" (which, although not a word, is commonly used to represent sleep in American slang and comic strips), the spelling checker recommends replacing it with the word "sex." The not-so-subliminal suggestion happens only with four Zs.



It puts me to sleep zzzz.

Not in Dictionary: zzzz
Change To:
Suggestions:
Add Words To: CUSTOM.DIC

Send yours to 76443.1723@compuserve.com!

Cameras Get Down to Business

Digital cameras are moving out of the realm of high-tech curiosity and into the world of everyday business. The ability of these cameras to let you preview images and upload them to a PC appeals to many consumers, at least in principle. But the execution of the first round or two of products left much to be desired, especially for cost-conscious businesses. The first digital cameras were often too expensive and too limited in quality, while suffering from less than optimal storage and battery life. That's all changing, however.

The latest digital cameras address many prior products' weaknesses while offering slick new capabilities and packaging. New storage options and improved software have also reached the market.

Early digital cameras often looked like high-tech binoculars. But newer cameras are smaller, and some have quite innovative form factors. For example, the new $499.95 PV-DC1000 PalmCam from Panasonic (201-348-7000; http://www.panasonic.com) weighs just 5.5 ounces, yet it delivers VGA quality and stores up to 94 images (at 320 by 240 resolution) or 32 images at finer (640 by 480) resolution. And it still manages to include a 1.2-inch LCD for playback of images. The camera runs off a rechargeable nicad battery.

Panasonic's PalmCam fits in your hand yet holds up to 94 images.

Another innovation comes from the $499 Coolpix 100 from Nikon (800-52-NIKON; http://www.nikonusa.com). This might be the ultimate digital camera for the road warrior. The Coolpix 100 is essentially a point-and-shoot camera on a PC Card: You can take photos and then access the images immediately by inserting the camera/card into a laptop or desktop PC. The images taken through the all-glass Nikon lens are very good. The camera can store 21 images in fine mode, 42 in normal mode.

Also notable is the new PowerShot 350 from Canon (800-848-4123; http://www.ccsi.canon.com). It has a 1.8-inch color LCD and a 350,000-pixel CCD sensor. The PowerShot uses a removable 2-MB CompactFlash card for storing up to 47 photos. The $699 camera is also available in a somewhat different version from Konica.

Image storage has been a big issue until now; many cameras haven't had a cheap and easy way to add extra "film." Now, several competing schemes are on the market, including Intel's newly released minicards, which are featured in both the Konica Q-EZ and the HP PhotoSmart Digital Camera (made by Konica). These tiny cards are inexpensive (about $50 for a 2-MB and $75 for a 4-MB card) and hold about 16 fine and 32 regular-quality images. The cards will be manufactured by Intel and other companies, so they should be widely available. An optional adapter lets you view images directly on screen without using the camera. Other vendors, including Canon and NEC, use the competing CompactFlash format.

All these improvements have analysts forecasting that the number of digital cameras sold will double this year compared to last year. Businesses that want to easily put images into documents and to share pictures with clients or other workers in a secure fashion (i.e., no outside processing) are helping to fuel this new demand. Says Jonathan Cassel, an analyst with Dataquest, "I think a lot of the growth for this market will come from business."

– Jon Pepper

Nikon's CoolPix is a camera on a card.

The Domain's the Thing

In addition to more bandwidth, the Internet needs more domain names. The Web's explosive growth has left everyone from individuals to corporate giants searching desperately for a recognizable name to call their own. Soon, if the International Ad Hoc Committee (IAHC; http://www.iahc.org/) has its way, a new set of top-level domain (TLD) names will ease the crush.

The IAHC is an organization of members from both Internet standard makers, such as the Internet Society and the Internet Assigned Numbers Authority, and international standards groups, such as the International Telecommunications Union and the World Intellectual Property Organization. The proposed new TLDs are:

.firm—for businesses or companies

.store—for businesses offering goods for purchase

.web—for entities emphasizing activities related to the WWW

.arts—for those emphasizing culture and entertainment

.rec—for sites about recreation/entertainment

.info—for entities providing information services

.nom—for individual or personal nomenclature

How real is this need for new names? Real enough that two other enterprises are going ahead with their own alternatives to IAHC plans. eDNS (http://www.edns.net) is proposing a free-market model for TLDs. Name Space (http://namespace.autono.net/) is already moving forward with its own domain name servers and customer-created TLDs. Without the blessing of a standard or coordination between the entities, though, these organizations may face trouble surviving with IAHC-expanded TLDs, which are expected to arrive soon. "If all goes well, you'll see the new TLDs by the end of the year," says Martin Burack, executive director of the Internet Society. And, with that, the Internet will have taken one more step from its academic roots to its commercial blossoms. **– Steven J. Vaughan-Nichols**

Survey

More Power, Lower Prices

New systems with the latest x86 processors from Intel and AMD have arrived. And based on a survey of leading PC vendors, you can expect to pay about $2900 for a fully configured 233-MHz Pentium II (PII), and about $300 to $400 less than that for a similarly configured system based on AMD's 233-MHz K6 processor. (For more information on these new CPUs' performance, see last month's Bits.)

In this survey, BYTE focused on 233-MHz systems to better gauge how K6 prices stack up against PII prices. The PII is also available in 266-MHz and, soon, 300-MHz versions, but the K6 currently maxes out at 233 MHz. Keeping in mind that system prices quoted here can go higher or lower depending on configuration and are subject to change at a moment's notice, here's a snapshot of what you will get and how much it will cost.

PENTIUM II SYSTEMS

AST Bravo LC 6233
233-MHz PII with 512-KB L2 cache; up to 128 MB of EDO memory; 2-GB EIDE hard drive; 16X CD-ROM drive; S3 Virge DX graphics (2 MB). Estimated street price: $2500. (800-876-4278; http://www.ast.com)

Acer 9606 Minitower
233-MHz PII; 32 MB of RAM. Estimated street price: $2949 with 17-inch monitor, $2449 without monitor. (800-551-ACER; http://www.acer.com)

Dell Dimension XPS H233
233-MHz PII; 64 MB of EDO ECC memory; 512-KB L2 cache; 4.3-GB hard drive; 17-inch Philips monitor; Matrox Millennium (4 MB); NEC 16X CD-ROM drive; Yamaha Wavetable Sound; Altec Lansing ACS 290 speakers; U.S. Robotics 33.6 Modem w/ Voice; USB. $3079. (800-BUY-DELL; http://www.dell.com)

Digital Celebris GL-2
233-MHz PII; 32 MB of RAM, 512-KB L2 cache; 3.2-GB EIDE hard disk, 16X CD-ROM drive, Matrox MGA Millennium graphics (2-MB WRAM), 10/100Base-TX auto Ethernet. $3313. (800-344-4825; http://www.digital.com)

Gateway 2000
233-MHz PII; 64 MB of RAM; 3.2-GB Fast ATA hard drive; Virge GX video (4 MB); 12X or 16X CD-ROM; Ensoniq Wavetable PCI Audio; Altec Lansing ACS 41 speakers; X2 Telepath 56-Kbps modem. $2889. (800-846-2000; http://www.gw2k.com)

Intergraph TD-225
233-MHz PII (dual-CPU capability); minitower; 64 MB of RAM; 512-KB cache; 1.7-GB hard drive; Matrox Millennium graphics (2-MB video RAM); Ensoniq wave-table sound card plus multimedia keyboard; 10Base-TX Ethernet card; 12X CD-ROM; floppy drive; 17-inch monitor. $3379. (800-763-0242; http://www.intergraph.com)

Polywell P7/233G
233-MHz PII; minitower; 32 MB of EDO RAM; 512-KB L2 cache; Diamond 3D S3-Virge 2000 (with 4 MB); Maxtor 5.1-GB Ultra-IDE, 5400-rpm hard disk; 1.44-MB floppy drive; keyboard, mouse; 12X EIDE CD-ROM drive; Crystal 16-bit sound; 17-inch monitor; Intel 100Pro 10/100MB EtherExpress PCI adapter card. $3337. (800-999-1278; http://www.polywell.com)

K6 SYSTEMS

CyberMax PowerMax A22
233-MHz K6; 512-KB pipeline burst L2 cache; 32 MB of RAM; 4-GB hard drive; Matrox MGA Millennium (4-MB WRAM); 16X Max CD-ROM drive; 17-inch monitor; Ensoniq 32-bit audio; Altec Lansing ACS 540 speakers and ACS 5250 subwoofer; 33.6-Kbps modem; keyboard with microphone. $2349. (800-433-9868; http://www.cybmax.com)

CyberMax PowerMax A51
Same as PowerMax A22 except 64 MB of EDO RAM; Matrox graphics (8 MB); ACS 400 and ACS 250 subwoofer. $2749.

Mitsuba
233-MHz K6; 32 MB of RAM; 512-KB synchronous pipeline L2 cache; 2.1-GB Quantum Fireball ST Ultra DMA hard drive; Trident 64-bit, graphics accelerator; 12X Toshiba CD-ROM drive; Intel EtherExpress Pro 10/100 adapter; Hyundai 17-inch monitor; mouse, keyboard. $2129. (909-392-2000; http://www .mitsuba.com)

Polywell K6233Mx
Same configuration as P7/233G but with 233-MHz K6 processor. $3021.

– Jason Krause

Spec Will Give PC Clusters Big-Iron Power

The encroachment of commodity PC servers into the realm of minis and mainframes may get a boost from a new software interface for server and workstation clustering. Microsoft, Compaq, Intel,

233MHz

Pentium® Processor with

MMX™

Technology

NOW, with MITAC's 5026, users can zap through their zip multimedia applications at rocket speed. The system comes with MMX™ technology, another Intel panacea for today's exacting computing. Boosting its performance by as much as 75-325%*, the MMX technology draws multimedia programs to this dapper portable and makes it a whiz at multimedia communication and image processing. With MMX technology, MITAC's 5026 can fly through 2D & 3D animation and telephony.

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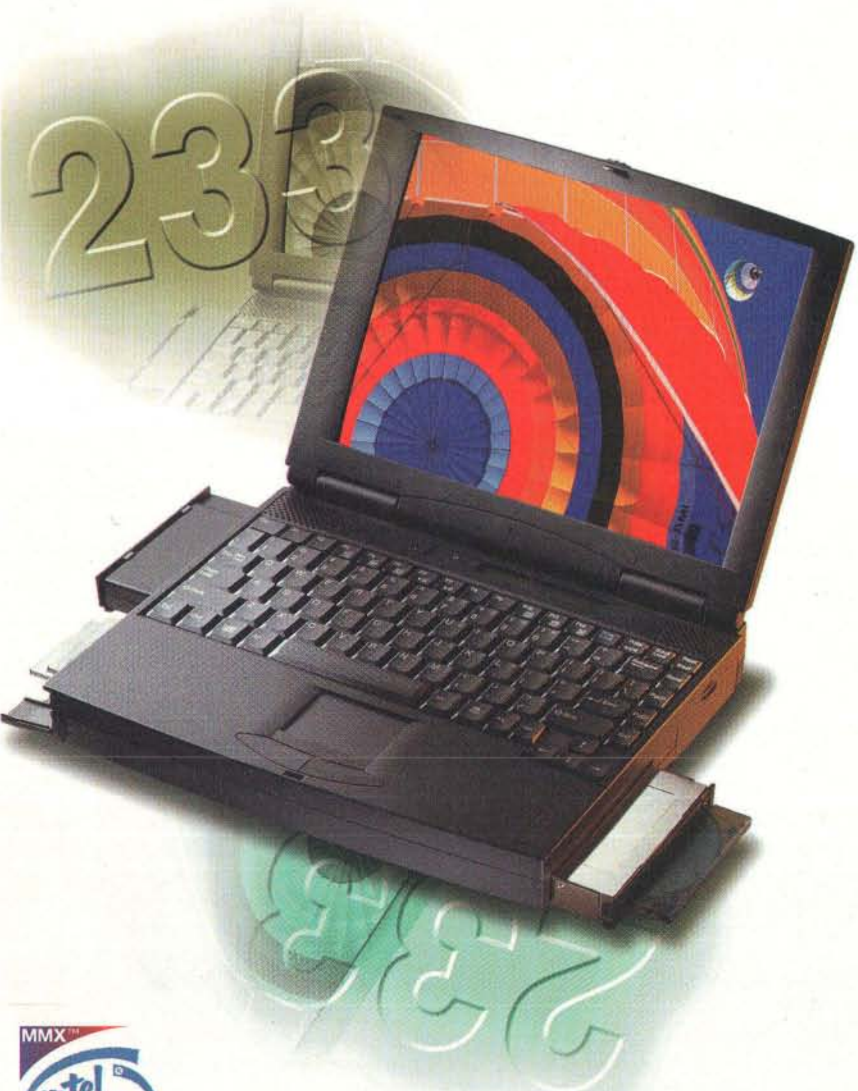
Arrayed with 12.1" TFT LCD accommodating millions of colors, MITAC's dual-bayed 5026 supports up to 3GB of HDD, up to 128MB of RAM, and of course the Intel Pentium® processor propelling at 233MHz.

Now, if you're like many end-suppliers who crave to give their professional customers all the best in modern portable computing, then you'd not hesitate to check out MITAC's cost-effective 5026.

So call, e-mail or fax us this week.



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Circle 447 on Inquiry Card (RESELLERS: 448).

*Based on video, audio and image processing elements of the Intel Media Benchmark
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Specifications are subject to change without notice.

and more than 40 other companies expect to finalize later this year the Virtual Interface Architecture (VIA) specification. VIA abstracts the details of special system area networks (SANs) used in clusters of PC servers. SANs are high-speed networks that connect PC servers, storage subsystems, and client workstations running distributed applications such as transaction processing and decision support. SANs, such as Tandem Computer's ServerNet and Dolphin Interconnect Solutions' Scalable Coherent Interface, consist of networking software and interface cards that let servers communicate over networks with lower latency and overhead than traditional Ethernet LANs.

One of VIA's goals is higher performance by reducing the latency due to context switching and protocol overhead when applications interact with a SAN. Another goal is to insulate application developers from having to know details of the hardware underlying SANs. "The specification will let developers write ambitious, cluster-aware software that will work with different companies' hardware," says Jim Henry, director of business development in Tandem's ServerNet unit. "End users will be able to pick low-performance or high-performance hardware, whichever is the appropriate solution, and know that their software will work with that hardware."

VIA represents another way, along with more scalable OSes, cluster-aware databases, and middleware, that PC servers are evolving to handle massive order-entry and other applications previously handled by mainframe computers.

Microsoft will support VIA in the second version (the one that handles more than two nodes) of its Wolfpack clustering technology, which is currently slated to enter beta testing in 1998, according to Mark Wood, product manager for Windows NT Server at Microsoft. Microsoft isn't the only OS vendor behind VIA; participants include Novell, SCO, and other developers of system software.

VIA will be compatible with asynchronous transfer mode (ATM), Ethernet, Fibre Channel, and other network architectures. The new technology's proponents say the spec will be OS- and hardware-independent, allowing people to use x86- or RISC-based servers to support mixed computing environments.

– Dave Andrews

Datapro Report

New Java Tools Cozy Up to Servers

With Java now two years old and taking the industry by storm, the biggest market is application development tools. Datapro sees the market today as having four distinct (and overlapping) generations.

The first generation began in December 1995, just before JavaSoft's Java Development Kit (JDK) 1.0 was commercially released. These early tools were primarily code-centric and ranged from the JDK, a bare-bones coding environment, to Symantec's Cafe, a complete interactive development environment (IDE).

The second generation provided developers with the first visual IDEs. These products included a coding environment as well as prebuilt graphical widgets for handling common objects like those used in constructing the user interface. The development tools released during the second half of 1996 fall into this category, including three of the best-known IDEs: SunSoft's Java WorkShop, Symantec's Visual Cafe, and Microsoft's Visual J++. Other tools in this category include ObjectShare's Parts for Java, Metrowerks' CodeWarrior (which works with Java as well as C++ and Pascal code), and Penumbra's Mojo.

Third-generation products let you create Java applications with little, if any, coding. AimTech's Jamba is an example of this type of toolkit; users create Java applets by filling in forms and manipulating visual objects, and the product automatically generates the corresponding Java code. (There is a way to insert your own Java code, but it's not easy.) Another is RandomNoise's Coda (due to be released this summer); it uses a desktop publishing-like interface to develop Java code.

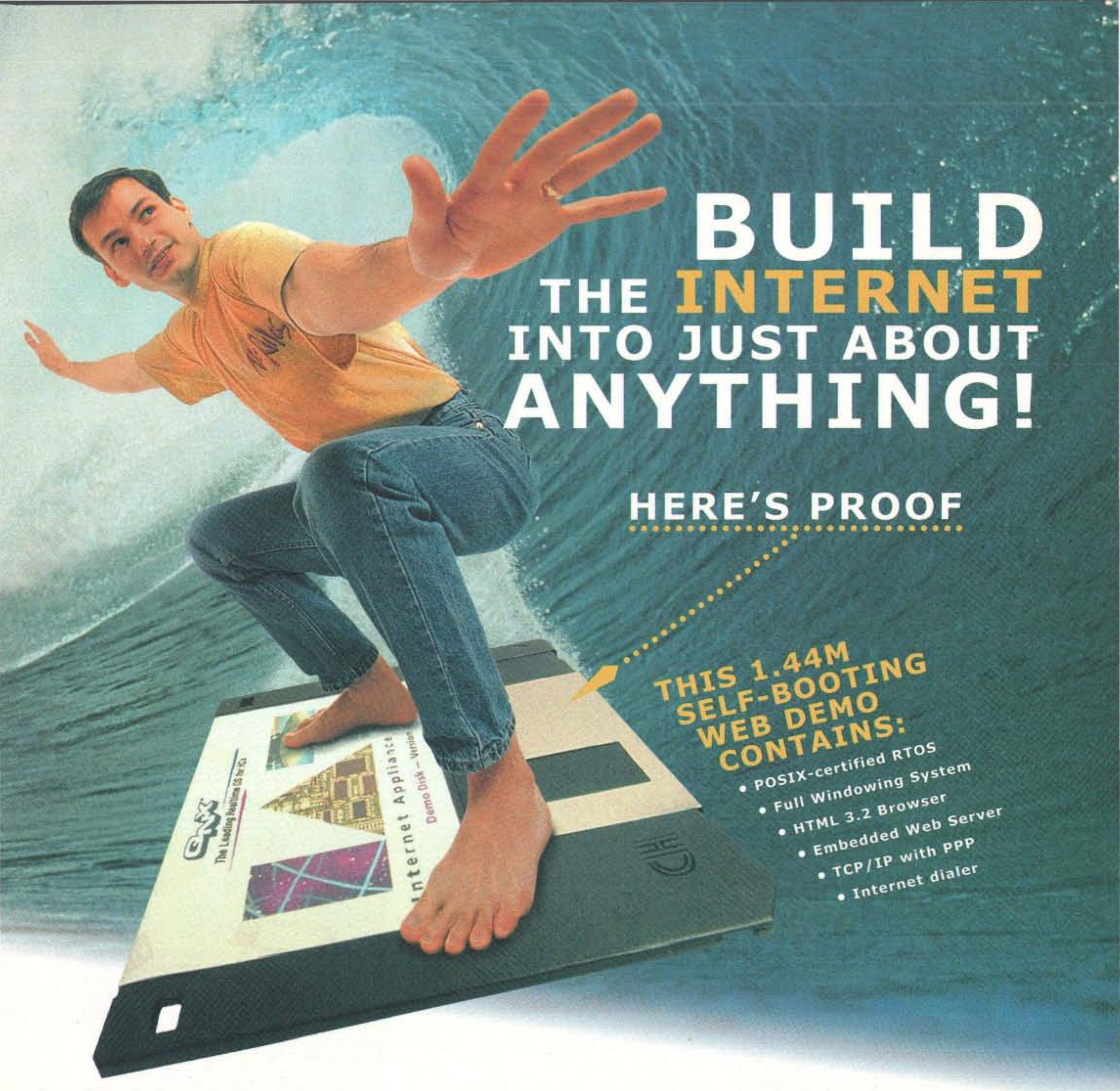
A fourth generation of tools offers the ability to build server-side Java. These packages began to appear on the market during the second half of 1996, but the new JDK 1.1, which provides server-side capabilities, will really launch these tools. Examples of these products include GemStone's GemStone for Java server, IBM's VisualAge for Java, SunSoft's upcoming JavaPlan CASE tool, and updated versions of Parts for Java, JavaWorkshop, and Visual J++. IBM is also working on a project to bring Java to the mainframe.

We expect to see many more third- and fourth-generation tools make an appearance in 1997.

Deborah Hess, *principal analyst for Datapro's Insight on Java service. For more information, call 609-764-0100; http://www.datapro.com.*

The Four Stages of Java Development Tools

Generation	Examples
First Code-centric; few, if any, visual tools *1995 to now*	• Java Development Kit 1.0, 1.1 • Netscape Navigator • Symantec Cafe
Second Visual development tools with coding environment *1996 to now*	• SunSoft Java Workshop • Symantec Visual Cafe • Microsoft Visual J++ 1.0 • ObjectShare Parts for Java 1.0 • Metrowerks CodeWarrior • Penumbra Mojo • Marimba Bongo • Castanet
Third Visual development tools with automatic code generation; may have limited coding capabilities *3Q 1996 to now*	• AimTech Jamba • RandomNoise Coda • Bluestone Sapphire/Web 3.0 • RogueWave JFactory
Fourth Server-side Java capabilities; may also have client-side development tools *1996 to now*	• GemStone for Java • IBM Visual Age for Java • SunSoft JavaPlan • Parts for Java 2.0 • Visual J++ 1.1 • JavaWorkshop 2.0



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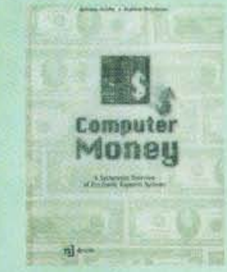
Book Reviews

New Money

For anyone who's looking for an understandable, well-focused introduction to how new electronic payment mechanisms and e-cash are evolving and changing the way we do business, *Computer Money* is a good place to begin. The book describes what electronic money systems are in service today, what's being developed, and how these systems work. The authors even briefly touch on the politics of how computer money, for example, diminishes the power of central banks, impinges on national currencies and international money movements, and creates a host of privacy issues.



– Rich Friedman

100 Laughs

This collection of 100 cartoons proves beyond a doubt that a funny computer cartoon is not an oxymoron. Included is work from some of the best cartoonists practicing today, such as Robert Mankoff, Charles Barsotti, Jack Ziegler, Roz Chast, and Arnie Levin, whose drawings appear frequently in *The New Yorker* and other magazines. The cartoons poke fun at everything from on-line romance to the computing nightmares we tend to rationalize as the small price we pay for "progress." The entire collection also comes on a CD-ROM (which is bound into the book), so you can print out your favorite cartoons or e-mail them to friends in need of a laugh.

The e-mail isn't functioning—pass it on.

– Rich Friedman

Is Your Web Site Up to Par?

Measuring the Impact of Your Web Site takes traditional standard business procedures and applies them effectively to planning, producing, implementing, and operating a Web site. For anyone without a business background, this book provides clear examples and step-by-step instructions for building a successful site.

From the initial planning stages to site development and statistical tracking, *Measuring the Impact of Your Web Site* delineates each step carefully, explaining how to gauge the success of your site through examination of raw statistical data (e.g., number of visitors) and on to quantifiable changes in your business, such as a decrease in time to resolve customer complaints. The authors intersperse actual case studies from FedEx, Toro, Star Tribune OnLine, Travelocity, and the United States Senate to show real-world problems and solutions.

Chapters focus on developing the content of your site to provide added value and marketing, as well as how to promote your site successfully. This includes solid information on leveraging your Web content in your company's intranet to increase internal support and efficiency. If you are serious about your site, read this book.

– Joy-Lyn S. Blake

Computer Money: A Systematic Overview of Electronic Payment Systems by Andreas Furche and Graham Wrightson; Morgan Kaufmann Publishers; ISBN 3-920993-54-3; $29.95; 115 pages; hardcover

e-mail.this.book, A Borzoi Book/Alfred A. Knopf; ISBN 0-679-45085-8; $17; hardcover with CD-ROM

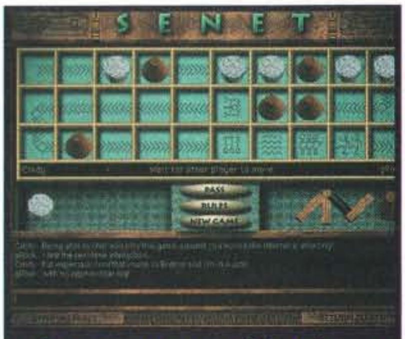
Measuring the Impact of Your Web Site, by Robert W. Buchanan Jr. and Charles Lukaszewski; Wiley; ISBN 047-117-2499; $29.95

Where the Past and the Future Meet

History disc portends the future of UI design

The Cartoon History of the Universe is part education program, part Internet interactive game, and part comic book campiness. The program's time machine takes you from primordial ooze to the glory of Greece, with quizzes and games along the way. You could justify this CD-ROM as a study aid for junior-high children or as a refresher for yourself. But computing professionals will also be interested in the program's user-interface techniques, which companies like Microsoft and Netscape are only now beginning to use.

For example, in the CD-ROM's "universal desktop," data is available on demand; you don't have to hunt around for it on your local hard drive, LAN, or the Internet. When you play the interactive game that resides on a remote Web server, the software hides the browser behind the game interface. The program ranks your quiz score with those of other players logged into the site, and you can communicate with them in chat sessions.



The Cartoon History of the Universe
Human Code, Austin, TX, 800-659-5455 or 512-477-5455; http://www.humancode.com; $24.95

Elements of this disc could easily be adapted for collaborative business software. This CD-ROM goes beyond history to show us what may be the future of UI design.

– Alan Joch

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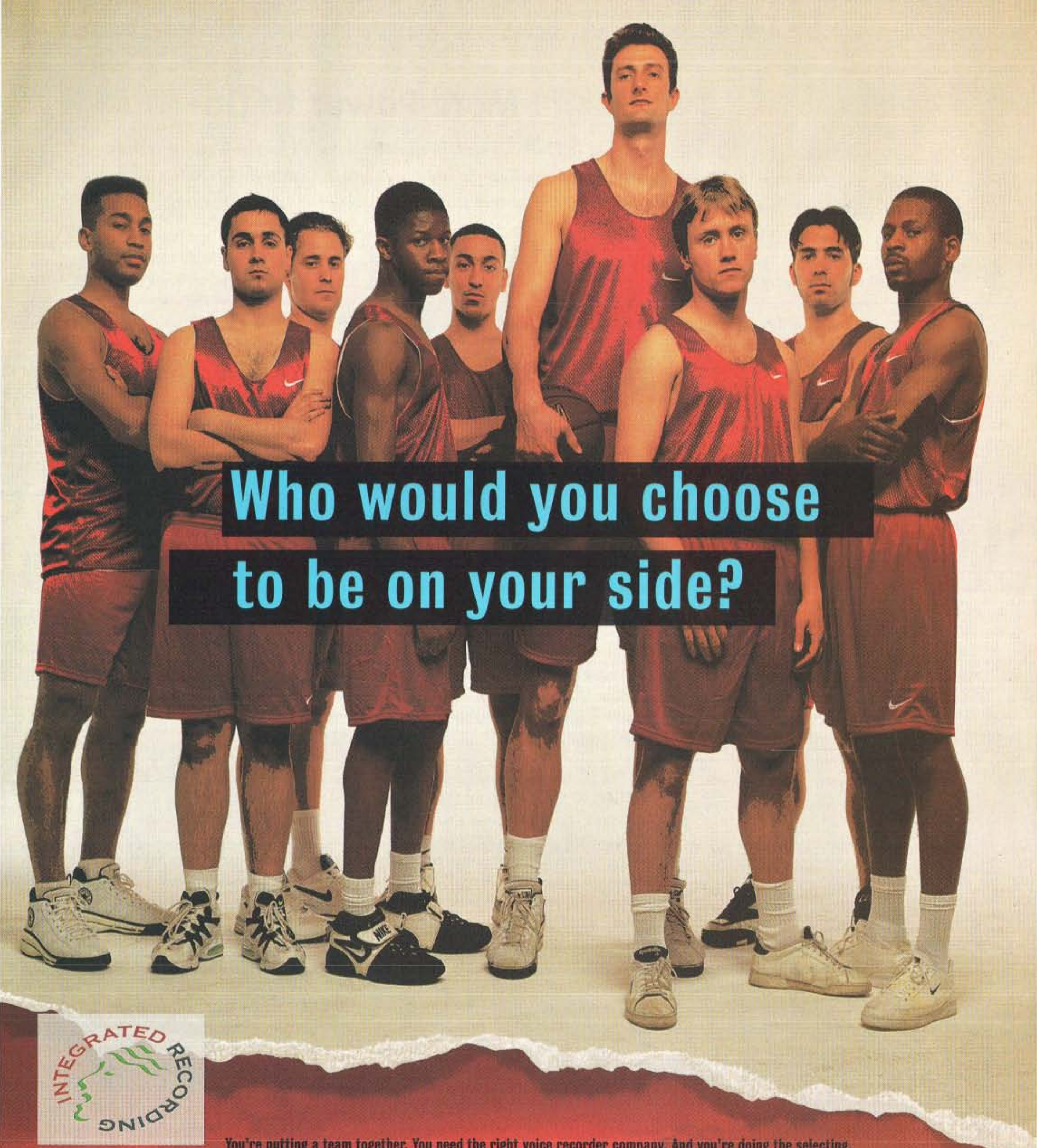

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Blasts from the Past

5 Years ago in BYTE

Windows NT was slated to enter beta testing and loomed as a threat to Unix and OS/2. Compaq pulled out of the ACE consortium; it seems Intel's processors would be powerful enough. Our cover story was about PDAs and subnotebooks. The PDAs' handwriting and communications capabilities weren't good enough, and subnotebooks, though technical marvels, were too small for doing a lot of real work.

10 Years ago in BYTE

BYTE's cross-platform tests of a Deskpro 386 with FPU against a Mac SE with a 68020 showed the 386 to be faster, but with plenty of caveats. Other articles covered image processing, encoding maps on CD-ROM, and LAN tutorials.

15 Years ago in BYTE

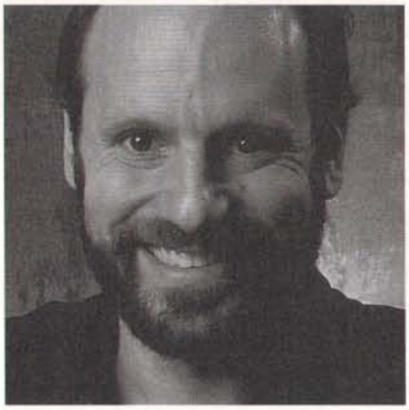
Articles on computers in the arts and sciences ranged from machine-generated poetry to using PCs for audio special effects, graphics, and even to predict wars.

20 Years ago in BYTE

An article explained the difficulty of implementing continuous voice recognition. Another story discussed using virtual memory to give your PC 1 MB of storage. We wrote: "Nobody expects a system to actually have a megabyte of on-line storage."

More Power to Go

Dr. Ted Selker, an IBM Fellow responsible for innovations such as the Trackpoint III pointing device and the Butterfly keyboard, discusses the current and future state of portable computing.



BYTE: *Are we going to see drastically smaller form factors in notebooks?*
Selker: Well, small is great, but what doesn't work is changing the basic QWERTY keyboard. Most people won't work with [non-QWERTY] keyboards. So we are looking at all sorts of possible designs, including a keyboard that clips onto your belt and one you can wear on your body.

BYTE: *That sounds somewhat radical.*
Selker: Well, it's all about the social situation, making the usage scenario fit. For example, 50 years ago people had all their focus at the desktop, and they wrote using pens they dipped into an inkwell. But then the ballpoint pen arrived and let them write away from the desk easily. Now, notebook technology is small enough, but the question is how to make the scenario fit so that it doesn't disturb the social situation.

BYTE: *What do you mean by that?*
Selker: Well, with some of these pen-based devices you pull one out and it is 30 seconds or a minute before anything happens. People end up getting distracted by the technology. That type of thing will have to fall away. Maybe we'll end up with technologies on our bodies, in our hands, or in our backpacks, but we have to look at how not to make it a big pile of things you need to think about all the time.

BYTE: *With all these devices—handhelds, phones, notebooks—will we ever get down to just having one device?*
Selker: Well, I am working on a mock-up that is based on the idea of a wallet. It would have a clock, and it could open in a trifold to be used as a phone. There could be a display inside that shows medical records and so on. I like the idea of a wallet as a metaphor. It is something that has all the really valuable stuff you have to have with you. You could even have a built-in scanner that could handle business cards and lots more. So I do think we are starting to get into a position where ultimately we can start eliminating the problem of having too many devices. But how can we make them? That is really the question.

BYTE: *Do you anticipate big changes in terms of form and function for notebook computers?*
Selker: I think it is going to be harder and harder for desktop machines to compete. What you get in a notebook today outperforms anything you got on a desktop two years ago. I think we are now there in terms of having everything you could ever want with you all the time.

BYTE: *Do you think we already have more technology than we need to get the job done?*
Selker: When I got my hands on a 286 portable it changed my life. I was riding a train [to work] and wrote twice as many papers as I had before I started using the portable. Now, everyone I know is replicating Lotus Notes databases and catching up with what's new on the Web as they ride the train. So more technology seems to let you do more types of things, and that is what I think more powerful notebooks will enable people to do. I think the mobile computing scenario is really changing things and truly letting people work anywhere.

BYTE EXTRA

INTERNATIONAL

Big Picture in a Small Package

A quarter-inch color LCD panel may revolutionize mobile computing. Page 32IS 3

New GSM Services

They will bring more intelligence to the network. Page 32IS 3

Desktop Data Mining

More intuitive data-mining tools for your PC. Page 32IS 7

Promises Unfulfilled

Virtual reality needs to solve some technical barriers for wider use. Page 32IS 11

Work Flow on the Web

ProzessWare helps build work-flow applications with Lotus Notes and the Domino Web server. Page 32IS 17

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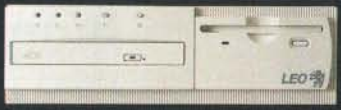

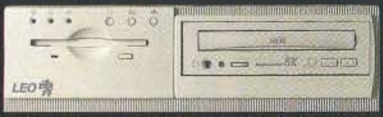

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Big Picture in a Small Package

A tiny new color LCD panel has the potential to revolutionize mobile computing.

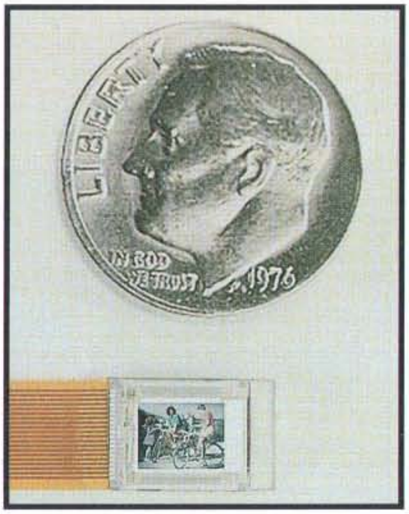
You've probably seen pictures of those portable "one-eye" displays, such as Rockwell uses with its Tracker wearable PCs. The displays are cute but cumbersome, and too expensive for everyday use.

Enter the next generation of this technology: The $600, 0.7-inch panel has shrunk to a 0.25- by 0.43-inch active-matrix LCD (AMLCD) chip that could provide display capability for the next generation of GSM phones, PDAs, and other hand-held mobile devices. This new monitor, called the CyberDisplay, is expected to sell to OEMs for $30 each, including the backlight. Developed by Kopin Corp. (Taunton, Massachusetts, U.S., +1-508-828-9999; http://www.kopin.com), the display will be manufactured in Taiwan.

The virtual display appears to the user similar to a 20-inch display at a distance of 5 feet. While the smaller panel is an evolutionary change, its impact may in fact be revolutionary. It is an enabling technology that could change the design of portable communications devices.

The first monochrome 320- by 240-pixel displays were scheduled to ship about the time this article appears, with color units to follow in three to four months. In a year or so the panels will be comparable to a 640 by 480 VGA display. Kopin will initially sell a $700 demonstration tool (with an SDK) that plugs into a VGA port, a $500 developer kit (same components, unassembled, with more lenses), and individual modules for $70 each in quantities of 10 to 100.

The displays are built using single-crystal silicon. The IC fab makes up the silicon wafers with needed circuitry, then peels off just the top layer and sticks that to a piece of glass. The whole unit is about 1.5-mm thick, with a tail for the input leads. Color versions are slightly more expensive to manufacture than mono (though color will be priced about 20 percent higher). They run at 60 Hz in mono and at 180 Hz for color sequential operation.


CyberDisplay is less than one-fourth the size of a U.S. dime.

Previous displays, from Japanese companies, have needed separate pixels and light sources for each color, notes Kopin marketing vice president Glen Kephart. The CyberDisplay builds color images by illuminating each pixel with blue, red, and green light in turn, as needed. Persistence of vision integrates the result into the desired color. Thus a 320-pixel-wide image needs only 320 pixels, regardless of whether it's color or mono. Smaller chips mean increased yields as well as allowing lower prices.

Kopin, an OEM, has no plans to make end-user products. Expect to see the first prototypes at Fall Comdex. Kopin says it currently can assemble 5 million CyberDisplay units a year, and its fab in Taiwan can produce 20 million a year.

Potential applications are everywhere because you can stick a display into almost anything. Kopin recently showed a demo mock-up of a Motorola StarTac cellular phone with an added arm containing a swiveling display. You could see the image easily as you talked.

–Russell Kay

Internet Innovations from Israel

Three Israeli start-ups are adding new dimensions to the Web. Geo Interactive has unveiled its streaming, no-plug-in-needed Emblaze multimedia player and accompanying Web-friendly Creator tool. V-Active, from Ephyx, adds interactivity to video films. And ICQ, from Mirabilis, lets you know when your friends and colleagues are on-line.

With the introduction of Emblaze, from Geo Interactive (Givatayim, Israel; http://www.emblaze.com), gone are the days of downloading special plug-ins and waiting endlessly for the grand appearance of multimedia. Using compression techniques that Geo claims yield up to 400 percent improvement over standard data compression—Internet traffic permitting—the Emblaze Player Java applet starts displaying the frames on screen as they arrive. Animation, at almost television quality, can include embedded hyperlinks. The applet also supports audio, video, bit maps, and vector graphics. Its partner authoring tool, Emblaze Creator, has two levels: a drag-and-drop interface for nonprogrammers and a deeper JavaScript level for programmers and Webmasters.

Taking video across the boundary from watch-only to interactive is Ephyx (Herzliya, Israel; http://www.ephyx.com). The company's V-Active hypervideo (video hyperlinking) technology enables the addition of hotspots to videos; these hotspots hyperlink to other types of media, including static pictures, text, sounds, URLs, video sequences, and even executable applications.

Until now, the only way to create hypervideo was with a frame-by-frame definition process; the cost, in time as well as money, was simply prohibitive for most people. The secret to V-Active's simplification and speeding-up of the technique is a powerful object-tracking engine that automatically identifies the objects defined as hotspots in digital video files. In a single still frame, the developer picks the objects to be linked. The V-Active playback environment then synchronizes all the content. The V-Active 1.0 suite includes an authoring tool, ActiveX and Netscape plug-ins, and Director Xtra for integrating hypervideo content created with Macromedia Director. The software runs under Windows 95 and NT; a Macintosh version of V-Active is expected later in the year.

Finally, an easy way to find out who else is on-line for real-time communications. ICQ ("I Seek You"), developed by six-month-old start-up Mirabilis (Tel Aviv; http://www.mirabilis.com), is a small piece of shareware.

Once downloaded from the Mirabilis Web site, ICQ allots you an ID number, then asks you to build up a contact list of friends' e-mail addresses. ICQ starts up automatically when you log on, then alerts you if one of your chosen pals is on-line or logs on while you are. You can then send a message, open a chat window, transfer files and URLs, or launch an Internet phone application.

Without any formal marketing except word of e-mail, the program acquired 400,000 users in just four months from its launch date, the company says.

– Tania Hershman

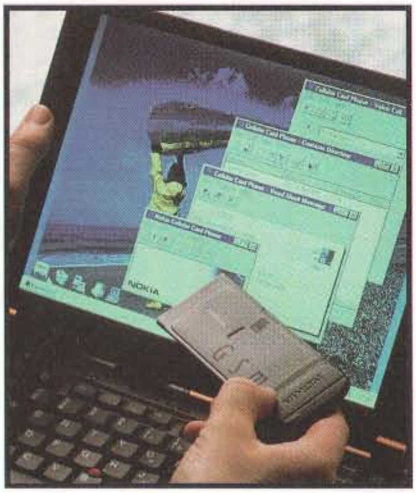
New GSM Network Services

The latest European GSM standards will soon bring more intelligence to the network. This will enable network operators to create new services and allow compliant phones to use advanced call-handling features such as intelligent transfer to a wireline phone if the mobile phone cannot be reached, with transfer to cellular voice mail if that second call is not completed. However, many subscribers are not even using the plain vanilla services of the existing network, according to European GSM service providers.

Some GSM vendors attribute this to the complexities of the user interface. "People know what they want to do next with mobile phones. They just don't know how to make it happen," says Ken Blakeslee, Nortel's director of business development and chairman of the Mobile Data Association. "The first challenge therefore is to deliver devices that make existing services such as messaging, directories, voice mail, and caller identity more intuitive. The next step will provide personal services that can be customized remotely from the network and by the user," Blakeslee says.

Nortel's Java-enabled device is designed to deliver e-mail and other information.

Ericsson and Nokia, for example, are addressing this issue with their new PC Cards that carry a complete GSM phone on-board. Plug one of these cards into your multimedia notebook and along with the short messages, faxes, e-mail, and remote access services you have a GSM speakerphone, with your notebook as the user interface of the phone.



Nokia Cellular Card Phone turns your notebook into a wireless speakerphone.

Motorola recently showed a "smart phone" that incorporates a notepad, organizer, e-mail, and pen-based interface. AEG Mobile Communication's Teleport 9080 aims to improve the user interface with voice dialing, which lets you make a call without using a keypad.

Nortel Europe is squeezing state-of-the-art computer technology into an intelligent unit it calls the Network Telephone. This pocket-size device incorporates a Java chip set that makes it a thin client communications terminal. It uses a touch-screen that integrates pen input technology and real-time handwriting recognition. Nortel plans to ship the Network Telephone in the first quarter of next year.

– Bob Emmerson

What's Next for GSM?

- More users; around 750,000 new subscribers worldwide open GSM accounts each month.
- You can dial frequently called numbers with voice command.
- No need for a PC Card to connect a notebook to a mobile phone. Data communications software for Windows 95 emulates modem functionality.
- A new compression algorithm squeezes about 50 percent more text into a standard Short Message Service (SMS) message, making it more cost-effective.
- Top-of-the-line mobile phones will have a built-in Web viewer with small font sizes for "push" information.

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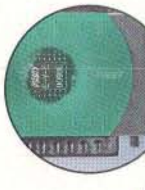

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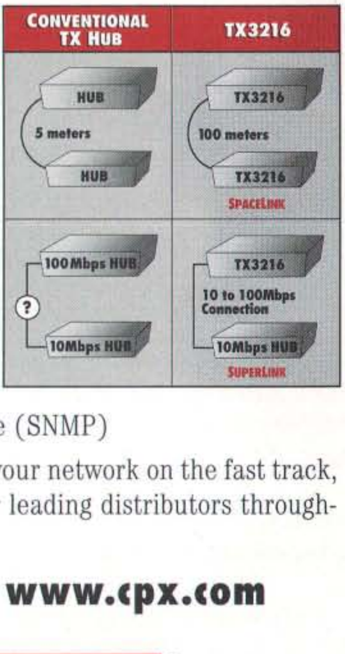

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Data Mining at Your Desk

More intuitive data mining tools are helping middle managers make better business decisions.

By Peter Hofland and Jim Utsler

As a result of flattened organizations within European companies, a new circle of employees now contributes to the decision-making process. Although they may not actually make the final decision, these people are responsible for giving recommendations based on their knowledge of the business. This increased responsibility is driving the demand among business professionals for data mining tools that allow them to more quickly and knowledgeably recommend actions to their management. Because these professionals are not data analysis specialists and are not trained as statisticians, they need tools that are easy to understand but nevertheless reliably reveal the multifaceted relationships in customer, product, or market databases. "Because of the explosion of computing power on desktop PCs, databases of more than a million records are often analyzed on standard Windows NT PCs," says Eric Tocatlian, marketing director at ISoft, a French developer of data mining software.

ILLUSTRATION: MARK STEARNEY © 1997

Until recently, most large organizations have employed statisticians to analyze the data crucial to their business. However, this is changing as marketing and product managers need to spot customer trends and patterns, find clusters and gaps in their data, create profiles, and detect anomalies without having to queue up for a statistician's time. And all too often the statistician's report results in piles of out-of-date information and arguments about what all the data means to the organization. "In a perfect world," says SAS Institute president Jim Goodnight, "companies would have business decision makers working alongside quantitative experts. But only a few companies can afford this ideal solution."

The new desktop data mining applications provide powerful but easy-to-use analysis tools for business professionals in marketing, finance, and strategic planning. One common thread of these tools is that they help users concentrate on business problems rather than on the nitty-gritty details of data analysis.

Desktop data mining tools deploy many of the same intelligent pattern-recognition technologies as the high-end tools from which they are often derived: neural nets, decision trees, rule induction, and fuzzy logic. (For more information on these analysis techniques, see "Endless Search," November 1995 BYTE international edition.)

Intuitive Interfaces

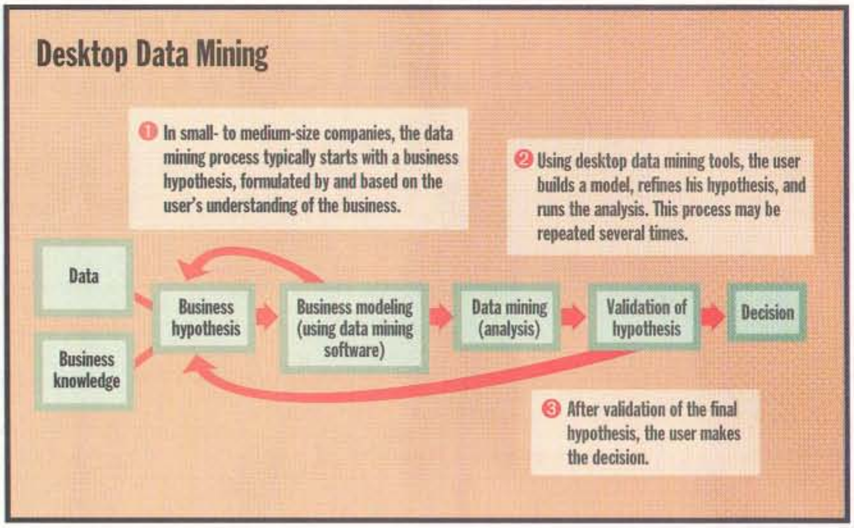
The key to most of these programs is the visual way they present data. For example, IVEE Development's Spotfire 1.0, a data mining system for Windows 95, NT, and Unix, has a number of sliders, one for each statistical variable. These sliders can be used to manipulate the data representation. This allows users to interactively scan through variables to detect interesting patterns (see "Visual Data Mining," page 32IS 8). It is also possible to display data along with background information, such as a map, to more easily detect interesting patterns.

Unlike the typical algorithmic data mining that is based on the AI techniques we mentioned earlier, data mining programs that have a visual interface are easier to use. They are limited, though, especially when compared to the flexibility of neural networks. Users are confined to their own knowledge of the particular data set. On the other hand, as Christopher Alberg of IVEE Development points out, "most professionals know their business better than a neural network does."

Indeed, the training of a neural network very often depends on the individual who trains it. That person can essentially lock an organization into an incomplete and subjective view of the data. This is why proponents of visual data mining argue that with personal attention and all the experience and knowledge front-line managers bring to the task, it is possible to quickly turn statistical results into a viable business strategy.

Some developers are adding enhanced visualization techniques to neural networks and decision tree-based systems. Cognos, a leading publisher of on-line analytical processing (OLAP) tools, recently acquired Right Information Systems, a developer of neural network-based software for business modeling and forecasting. The companies are now merging both approaches to make their software easier to use.

Another example is the SAS Institute's development project code-named DMINE, a combination of neural networks, decision trees, and visualization techniques aimed at predictive modeling in business areas. DMINE is expected to be released this fall. "Today," says Phil Winters, SAS Institute Europe's vice president of marketing, "business decision makers spend a lot of their time sending queries to databases. We propose a more proactive way of predictive modeling."



① In small- to medium-size companies, the data mining process typically starts with a business hypothesis, formulated by and based on the user's understanding of the business.

② Using desktop data mining tools, the user builds a model, refines his hypothesis, and runs the analysis. This process may be repeated several times.

③ After validation of the final hypothesis, the user makes the decision.

The decision-making process takes into account the relevant data and a manager's knowledge of the business.

Five-Step Approach

In an effort to make data mining accessible to a wider audience and to help decision makers run data mining systems on their PCs, SAS Institute promotes a methodology that includes five basic steps: sampling, exploring, manipulating, modeling, and assessing. This methodology suggests sampling smaller portions of a database rather than the entire data set in order to reduce processing time. Data visualization helps the user find the right subsets to be sampled. If the data is too complex for graphical representation, then traditional statistical methods such as factor, cluster, and correspondence analysis are required.

Based on this kind of data exploration, a user can cleanse and update the selected portion and then run the actual mining process, which computes the most pertinent criteria that belong to a given set of data (modeling). In a direct marketing application, these criteria could differentiate (e.g., by age, gender, income) between customer groups. In the final stage of the process, the user assesses and evaluates these models and checks their value for the real-world business problem.

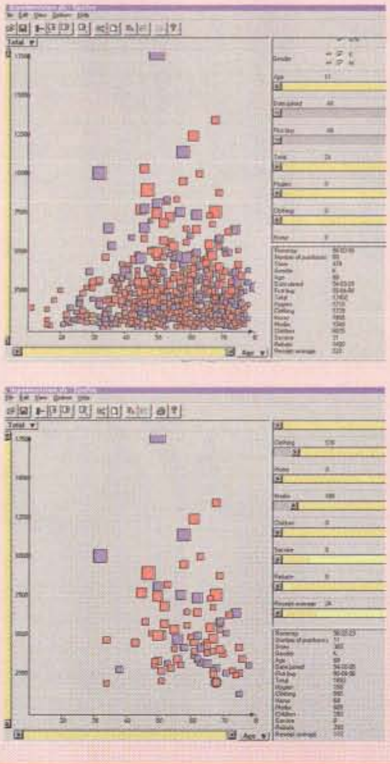
ISoft launched a trimmed-down version of its product called Alice late last year. Alice uses a wide range of statistical algorithms to build predictive models. The program represents the model's results in decision trees, giving the user an immediate grasp of the basic data correlation and allowing for an easy check of hypotheses.

Part of what makes decision trees so

Visual Data Mining

In contrast to standard statistical analysis programs, visual mining allows users to interactively explore data using helpful graphs, charts, or interfaces that may employ colors, filters, animation, and different levels of detail. IVEE's Spotfire 1.0, for example, can represent data in a 2-D scatter plot. Along with this representation, it creates a number of sliders, one for each statistical variable; these sliders can be used to manipulate the data representation.

The Spotfire screen at upper right shows a customer database of a department store. Each colored marker represents a customer, colored by gender, with marker size conveying the amount of money spent on clothing. You can select details of particular customers by clicking on the marker. To filter only those customers who have purchased clothing for at least $500, for example, you simply move the corresponding slider to the right. The lower screen displays this selection. Simultaneously, the screen indicates that most of these customers are older than 45 (*x* axis), two-thirds of whom are women (red), and most have spent more than $2500 (*y* axis). It's that easy to identify a clear market segment in a customer database.



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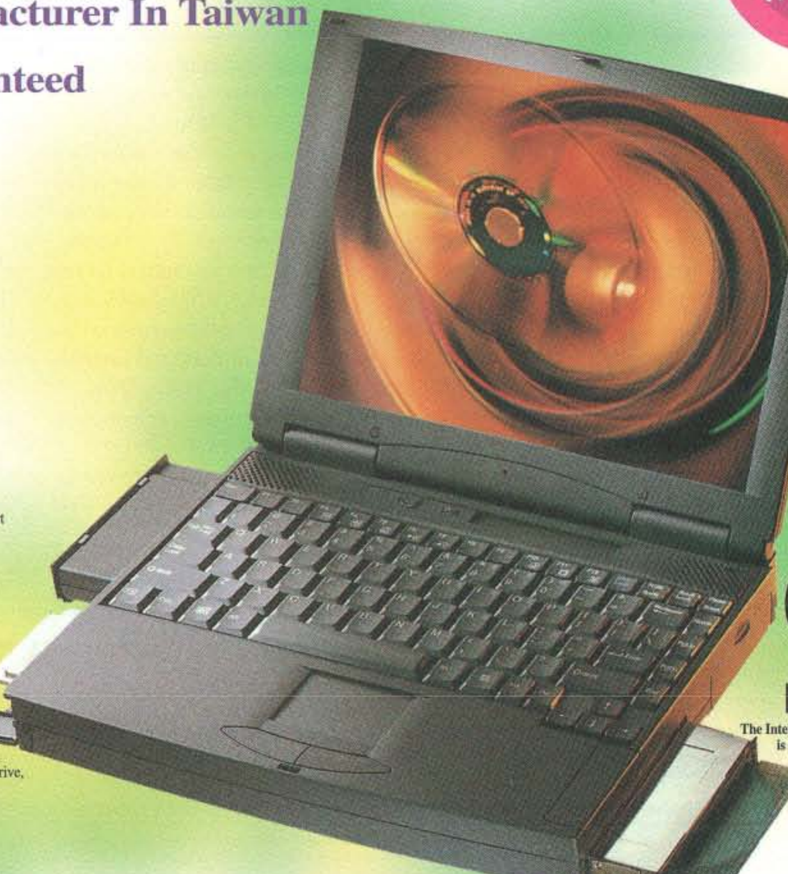

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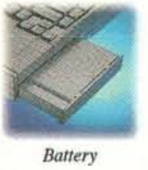

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attractive in desktop data mining programs is their ability to represent high volumes of data efficiently. With a decision tree, a user can force splits, merge nodes, collapse or expand branches, and determine the number of parameters in a tree. In addition, the user can easily select only those branches he or she is interested in.

"Explainable Documents"

Data mining systems can detect how some objects or variables affect others, locate changes over time, or spot trends in customer databases. However, the way they express this information is often arcane and too complicated for some business managers to comprehend. "That's not appropriate for business users," says Dr. Kamran Parsaye, CEO of Information Discovery Systems. Interactive OLAP systems, for example, allow users to zoom into details. But the zoom features present tabular information that may not be clear to nonexperts. "What we need is a language that helps machines express their knowledge for the direct benefit of business users," Parsaye says.

Output from data mining systems should be expressed in what Parsaye calls "explainable documents." Explainable documents automatically generate hyperlinked text, graphs, and data summaries to express the influences, affinities, comparisons, variations, and trends found in the data.

Explainable documents, as implemented in the company's Intra/Knowledge system, explain the results of a data mining process in plain statements, such as: "Sales went up last quarter because orange juice sales in Arizona were above expectations due to discounts."

Intra/Knowledge provides results that are automatically generated from a database and delivered over a company's intranet. In a financial institution, for example, the program may read through the raw data and documents generated each day, discover key trends, and then convert the analysis into easy-to-understand English text supplemented with 3-D graphics.

An alternative approach, rule induction, works with nonhierarchical sets of conditions, in contrast to the strictly hierarchical nature of decision trees. Unlike neural networks, for example, rule induction allows for the determination of both the probability of a rule and the rule's error probability.

Define the Rules

Though it does not deliver reports in graphical formats, WizWhy, a rule induction-based data mining tool developed by WizSoft, for Win 95 and NT, gives operators the ability to tailor the analysis by defining a variety of parameters. These parameters include the minimum probabilities of the rules and the minimum number of cases in each rule. This is comparable to using decision trees, which allow you to limit queries by refining trees and the number of branches.

These quantitative rule-induction methods have often been employed by specialists in medical research to discover, for example, patterns between symptoms and diseases. But with WizWhy, less experienced users can analyze rules in customer databases and check for deviations, the frequency of deviations, and the level of probability of detected rules without having to understand the complex underlying algorithm.

Although the emerging generation of desktop data mining products can't replace a data warehouse in a large enterprise, they enhance the effectiveness of many front-line managers. And they bring data mining to many small and medium organizations that couldn't afford a dedicated data-analysis specialist. ■

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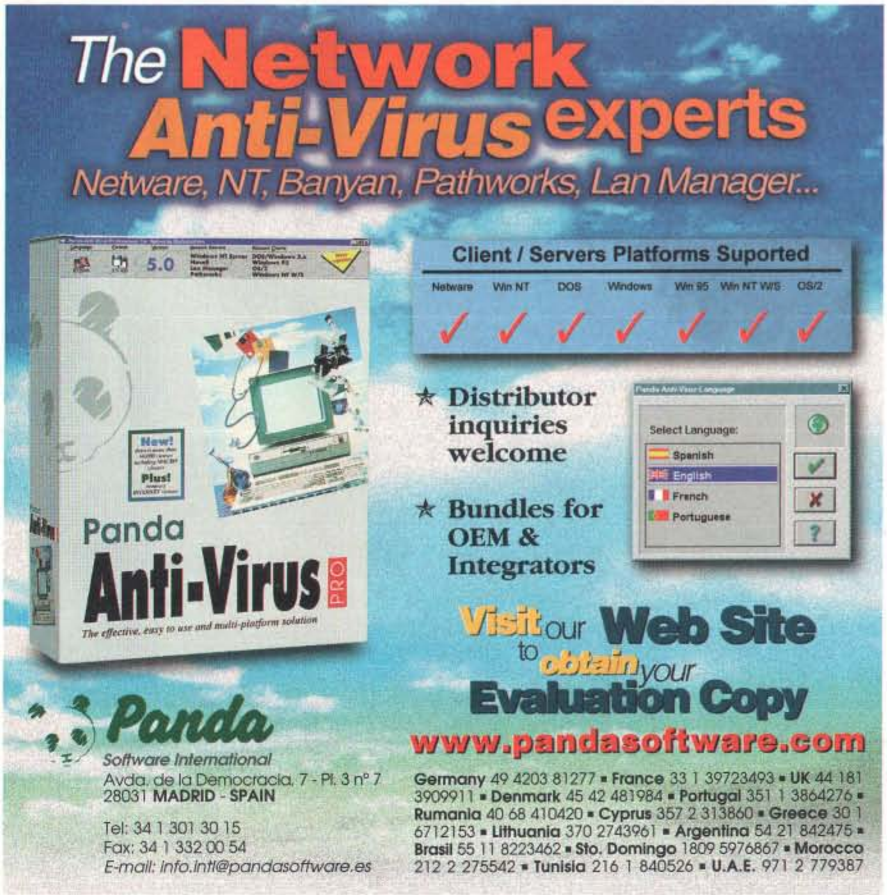
Peter Hofland and Jim Utsler are technology journalists at The Visual Consultancy Corporation in Amsterdam. You can reach them at **100544.307@compuserve.com.**



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Promises Unfulfilled

Virtual reality needs to overcome some technical barriers to move into mainstream industrial applications.

By Bruce Page

Today, it's no longer enough for virtual reality (VR) simply to be a great technology. "The honeymoon is over," says Jim Radford, a member of the VR development team at Paris-based Medialab. "People are tired of seeing demos. Engineers want to see real applications that help them with their design problems."

Nowhere is the appetite for virtual design and prototyping more insatiable than in the automotive and aerospace industries. Prototyping is an essential but costly step of the product-development process in these industries. Prototypes represent important features of a product that engineers must evaluate and improve. Prototypes help engineers choose design alternatives, analyze the manufacturing process, and demonstrate a new product to a potential customer. Virtual prototyping can dramatically cut development times and reduce costs.

"The automotive industry is making serious use of VR," says Fan Dai, a visualization and VR project manager at the Fraunhofer Institute for Computer Graphics (IGD). The German manufacturers BMW, Daimler-Benz, and Volkswagen, for example, have used real-time, interactive, and immersive VR systems to design parts of the bodies of their latest cars and to optimize the ergonomics in the driver cabin.

ILLUSTRATION: MARK STEARNEY © 1997

Last year, Daimler-Benz invested DM 5,000,000 in its Virtual Reality Competence Center in Ulm, Germany. VRCC researchers are developing VR solutions and integrating VR systems and components to support the development and production groups.

Other industries, however, are still skeptical about the real-world deployment of VR. One main impediment is the high cost of immersive systems. Another impediment is the lack of consistent 3-D data sets, because outside the European automotive and aerospace industries, 3-D modeling throughout the whole design process is still rare (see "3-D Meets Manufacturing," December 1996 BYTE International Edition).

"The lack of international standards along with high costs are curtailing the use of VR tools," says Franz May, Daimler-Benz's VRCC director.

One major problem limiting VR's usefulness in industry, according to Stefan Muller, head of the visualization and VR department at the IGD lab, is an insufficient level of integration between CAD systems and VR systems. "At the moment, it's a one-way communication between CAD and VR—once you send your CAD data to the VR system for rendering into three dimensions, you can't send it back to the CAD system again."

The reason VR data can't go back home again is that to achieve the levels of performance required for real-time rendering, VR systems typically use only part of the data that industrial CAD systems generate. Thus, data that comes back from the VR system is unusable for design purposes, even though it contains attributes regarding textures and kinetics that the CAD format lacks. As a result, says Medialab's Radford, VR "is not yet accepted as part of the design loop" in industrial applications.

The Next Step

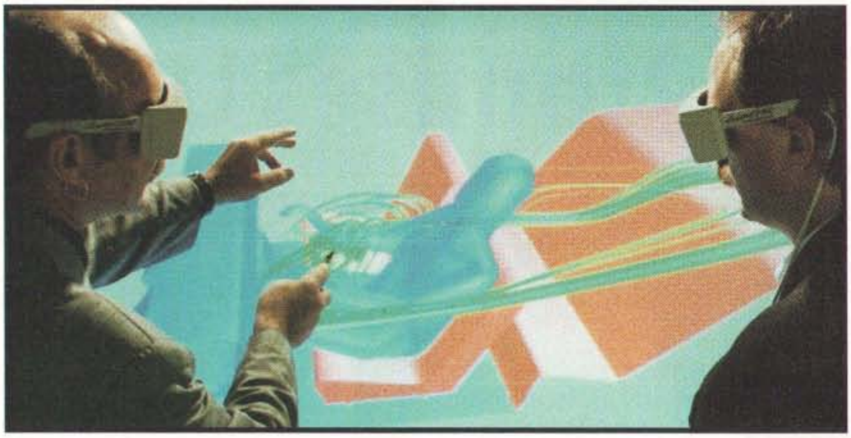
VR has gotten a great deal of play in the media lately for "helmet-and-glove" game applications, making it difficult for vendors to sell expensive VR equipment. Consequently, VR companies sell mostly computer-aided simulation tools or information-acquisition and analysis systems. The new focus of many VR developers is serving business needs.

However, in business, companies will judge VR by the same criteria that they apply to traditional computing purchases: Can it do the job better, faster, or cheaper than existing solutions? For obvious reasons, the areas in which VR is most able to respond affirmatively are in applications that involve spatial analysis or visualizations on physical dimensions. VR's ability to present data in 3-D and incorporate audio and tactile information can add greatly to your ability to comprehend the meaning of data. This is especially true with large data sets.

"When we represent real-time financial data using VR techniques, it becomes immediately obvious what is happening in the market in real time," says David Hendon, sales manager at Virtual Presence, a VR distributor and integrator.

VR's move into general markets means that developers are now creating applications for standard hardware and software platforms. Standard desktop computers may run simple VR applications. This permits the use of a fishbowl interface (see the text box "Different Types of VR Systems" on page 32IS 13), in which you can navigate through space using nothing more than a mouse or joystick and a conventional monitor.

The release of dual-processor Pentium Pro systems, support for symmetric multiprocessing (SMP) in the Windows NT kernel, and the growing number of OpenGL graphics accelerator cards are making VR applications more cost-effective. However, high-end VR still requires the use of networked workstations or supercomputers, the faster the better.



Immersive VR systems are used in only 1 percent of current VR applications.

Not Ready for Prime Time

VR vendors are facing a number of challenges in developing products that meet the needs of business users. Without solutions to these problems, VR is not ready for prime time in business.

"The main problem we have to solve today is coming up with new models for interaction," suggests Andreas Roessler, VR project head at the Fraunhofer Institute for Industrial Engineering (IAO). "We don't really fully understand yet how to interact with virtual objects in virtual worlds."

The key to solving this problem, Roessler believes, is finding ways of increasing the amount of feedback VR systems can provide to users. You might do this by adding acoustic models into systems to inform users that collisions have occurred or adding force-feedback loops into input systems such as gloves.

Another challenge in bringing VR into the mainstream is the need to combine multiple VR subsystems into a single cohesive system. While immersive VR presents its own challenges, 3-D sound feedback and force feedback multiply these challenges dramatically. Only when subsystems are in perfect communication can you coordinate their output in a seamless way. These challenges present the need to develop communications protocols and open interfaces to permit the cofunctioning of disparate VR systems.

One step toward that future is taking place in the form of distributed VR systems. Distributed VR lets engineers in separate locations work on the same virtual objects at the same time. The dVise VR development environment from Division, for example, allows for real-time interaction by multiple users across the Internet. What's more, these users may be running a variety of platforms, from NT-based

Modeling the Human Body

Humans are so highly complex that it requires an in-depth understanding of their biomechanics to simulate their behavior in virtual reality (VR). VirtualAnthropos, developed by the Fraunhofer Institute for Industrial Engineering (IAO) and IST, is a major step in the modeling of human behavior in VR.

VirtualAnthropos provides six motion trackers that control the motion of human models in real time. It uses several movement stereotypes (e.g., walking and sitting down) to animate models in cyberspace, automatically recognize collisions in a defined environment, and react to collisions by retreating or initiating contact.

The models' movement apparatus consists of 90 joints with up to five axes, including a 24-part spine and hands with five fingers. It even includes typical biomechanically constrained movements such as upper arm-shoulder or thigh-pelvis-spine. The models' surfaces consist of 3200 skin sensor points. You can choose models by nationality, sex, age, and height.

"VirtualAnthropos provides the high level of detail that is required for realistic human modeling in industrial applications," says the IAO's Andreas Roessler. The IAO uses VirtualAnthropos to simulate complex production processes at workplaces and in process chains. Although it's still not possible to directly benchmark assembly times in VR, researchers at the IAO count the number of separate VirtualAnthropos movements in cyberspace and match them with real assembly times stored in a database. Says Roessler: "We get good estimates of assembly times long before a factory is built."

–Rainer Mauth

VirtualAnthropos helps to estimate manufacturing process effectiveness.

machines with flat screens, to immersive systems that are based on Silicon Graphics' high-end Infinite Reality machines.

Out of the Lab

In spite of the challenges, there is real progress in bringing VR out of the labs and onto the streets. For example, applications-oriented research centers such as the Fraunhofer Institutes have developed several real-world VR applications.

The Fraunhofer Institute for Factory Operation and Automation (IFF) developed a VR-based factory-planning system called Mowib that lets users dynamically interact with plants while a process simulation is running. With this system, users can, for example, move objects in a virtual factory and directly see the impact on the efficiency of a production process. Because of the direct feedback loop and the close combination of interactive VR and dynamic simulations, users can more easily find the best layout of workplaces and the general factory setup.

The use of VR in a factory layout lets planners capitalize on the experience of

Different Types of VR Systems

Different virtual reality (VR) applications require different input and output devices. Input typically comes using data gloves and 3-D mice, while VR output is being delivered by goggles, helmets, 3-D sound equipment, or projection rooms that create the sensory impression of being inside virtual spaces.

There are four basic types of VR systems:

Desktop VR: Also known as fishbowl VR, it uses a standard computer monitor to portray the 3-D space. It requires you to wear shutter glasses, which produce a stereoscopic view of the images on the screen. You make mouse movements to define new viewpoints, which are instantly recalculated to provide new perspectives, giving only a crude sense of motion and space.

Immersive VR: Immersive systems involve the use of a head-mounted display (HMD) such as a data helmet or goggles to deliver stereo images that provide depth information and thus the impression of physical space. You also use a computerized sensing glove to point to, grab, and move virtual objects in the VR space.

Augmented reality systems: In such a system, you see the real world, either directly around you (i.e., real reality) or from a different site (i.e., telepresence). Artificial images are then superimposed to provide objects of the real world with additional information (e.g., descriptions) or by presenting objects invisible to the human eye (e.g., hidden pipelines).

Projection systems or CAVEs: At the top of the VR food chain are projection systems, also known as computer-assisted virtual environments (CAVEs). You sit in a room that's equipped with several projection surfaces. By the use of shutter glasses, CAVEs create a highly convincing 3-D space for one or several users. Users can see their bodies, helping to avoid dizziness and loss of bearing. Unlike HMDs, CAVEs allow for permanent communication between group members.

A fully equipped CAVE can cost over a million dollars, and few are in operation today. There are only three CAVEs in Germany.

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the blue-collar workers who will eventually manage the production lines. Says Jörg Bergbauer, project manager at the IFF, "VR provides a means of getting the input of employees with substantial real-world experience but who are usually not involved in the planning process." Factory planners at Asch AG, a pharmaceutical company in Hamburg, used Mowib in a recent reengineering project to include employees' feedback in the planning stage.

At Fraunhofer's IAO, researchers developed a virtual assembly-planning system that lets automobile builders determine in advance whether new parts under development will fit together, whether workers can assemble them by hand, and whether the hand of a worker will fit in a space, given the articulations of wrists, elbows, and shoulders. A significant extension to this ergonomic planning is the use of human models with biomechanical intelligence (see the text box "Modeling the Human Body" on page 32IS 12).

VR is also an excellent way to communicate visually rich and technically complex information. An example of using VR in marketing communications is the *cyberdrome*, which explains complex technical issues using a virtual fly-through. Volkswagen used a cyberdrome at the Detroit Motor Show to demonstrate in detail the functioning of its new TDI engine, a high-efficiency diesel engine.

Other VR business applications facilitate the creation of optimal buying environments. Supermarket chains such as Sainsbury's in the U.K. are experimenting with the simulation of different product placements. They can thus see the visual impact of a new product before physically rearranging the products on hundreds of store shelves.

Although VR techniques and systems are being perfected in the lab and are beginning to trickle down into real business applications, they still lack wide acceptance in most industries. Today's major challenge is to integrate these VR applications with standard business software. Then, navigating in 3-D virtual spaces will be as common as filling in the cells of a spreadsheet. **B**

Bruce Page is a freelance writer based in Paris. You can reach him by sending e-mail to **cbpage@acropolis.com.**

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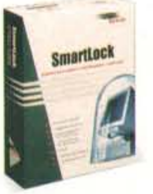

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This month, we preview a new computer telephony integration board and work-flow software for Lotus Notes.

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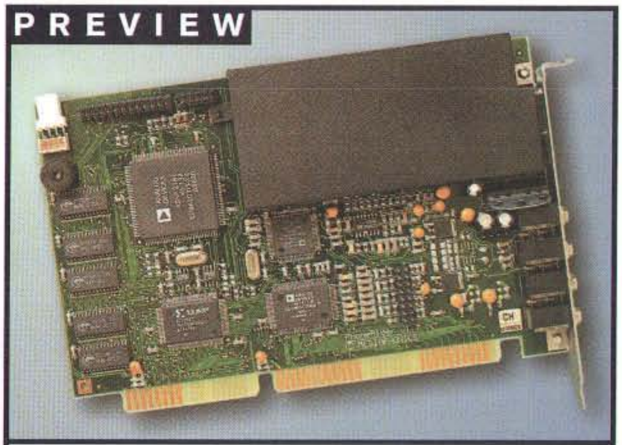

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Turn Your Phone into a Full-Fledged PC Partner

Most of today's PC telephony solutions emulate the functionality of a phone in software by turning your PC into a speakerphone, but they don't give you control over the call. You can't accept a call and switch it to another handset, you can't record a conversation, and you are not able to forward voice mail to other users. In other words, the phone doesn't integrate well with the TAPI- and MAPI-compliant applications on your Windows 95 desktop.

PhoneRider changes this predicament. This new telephony board makes the integrated 33.6-Kbps voice and data modem a digital extension of the PC and combines it with the messaging capabilities you are used to. By digitizing the incoming voice signal before you hear it, PhoneRider gives you full control over the call. For example, you can switch naturally to and from a regular handset or another speakerphone and set up conference calls. Your PC will always know what type of terminal is active. You can also record voices at any time during a conversation.

Digitizing the audio signal makes voice quality and echo cancellation better, which is particularly important for speakerphones. For example, I placed the microphone in front of the speakers without getting any acoustic feedback.

PhoneRider comes as an ISA board, but the company says an external version that connects to a USB interface will be available later this year. The system can also run in client/server mode, giving you a full-featured Intelligent Voice Recognition solution with an auto-attendant and multiple mailboxes on the server.

–Bob Emmerson

Communications

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ALLOWING USERS TO CONVERSE AND SEND data simultaneously over a single standard phone line, the OfficePorte voice/data modem can be used to run remote-training and technical-support applications. This 33.6-Kbps modem contains a microphone and a speakerphone, and supports V.42bis and MNP level 5 data compression.
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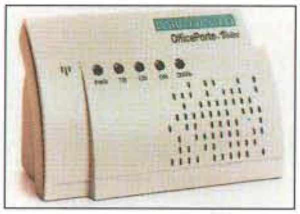

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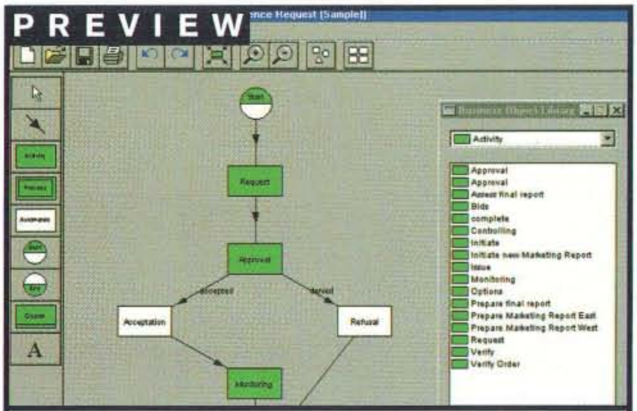
IF YOU USUALLY HAVE TO RESTART YOUR Internet download several times because you lose connection to your ISP, Smartload may help. Based on FTP, it continues interrupted downloads without any loss of already-transmitted bytes. If you install Smartload on a Windows NT Web server, it provides a hassle-free way to load just what's missing when you were cut off. The client program comes as either a plug-in to Netscape Navigator or an ActiveX control for Microsoft Internet Explorer.

Price: DM 299 (server license; client is free).
MediaObjects, Regensburg, Germany, +49 1941 296 300;
fax: +49 1941 296 3088;
office@mediaobjects.com;
http://www.smartload.com.
Enter 988 on Inquiry Card.

PREVIEW



ProzessWare
Starts at DM 17,000 (50-user license)

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Paderborn, Germany
+49 5251 136510
fax: +49 5251 136513
info@onestone.de
http://www.onestone.de

ProzessWare Brings Work Flow to the Web

Lotus Notes and the Domino Web server provide the essential services that let developers build Web-enabled work-flow applications. However, the tools lack a graphical development environment that lets developers separate process flow and application logic. This is critical because business rules and responsibilities in an organization change over time. ProzessWare lets you configure roles and routing logic without having to modify the application's structure.

ProzessWare includes a graphical map builder with rule-based routing, reusable activity and subflow templates, deadlines, agent tasks, and a flexible concept of role administration. This native Lotus Notes application organizes all work-flow elements in four Notes databases: Application, Organization Directory, Process Definition, and Design Repository.

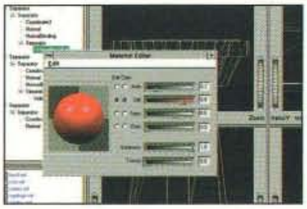
With ProzessWare, you don't need to stick to structured work flows. You can handle messaging-oriented, ad hoc work flows, and you can base the process flow on e-mail or replication.

A Domino server running the current version of the ProzessWare work-flow engine lets users launch a work item and track the status of a process from any Web browser. The next version of ProzessWare, scheduled for release later this year, will be completely Web-ready. A Web browser will then qualify as a full work-flow client.

–Volker Weber

VRML Modeler for the PC

WOERML, A PC-BASED VRML MODELER, produces 3-D interactive and dynamic content for the Internet. The system includes a type browser, which shows object groups in a hierarchical tree structure; several scripting and scene windows; and a property browser, which lets you assign kinematics to objects. The software is available for Windows NT, Windows 95, and Silicon Graphics workstations.



Price: Starts at $1000.
VR-Systems, Munich, Germany, +49 89 32 450321;
fax: +49 89 32 5008;
http://www.VST.de.
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Development

More Flexibility for Notes Applications

WORKBENCH4NOTES, A DEVELOPMENT AND administration environment for Lotus Notes, includes a component library, template and parameter database, and developer guidelines. The database lets you separate application and business layers, so that changes in the organizational structure do not affect the application logic.

Price: Call company.
What's Up, Unterhaching, Germany, +49 89 61347 217;
fax: +49 89 61347 149;
http://www.whatsup.de.
Enter 993 on Inquiry Card.

Graphics

Printed Circuit Board Software

VERSION 3.5 OF THE EAGLE PRINTED CIRCUIT board design package runs under Windows 95 and NT. The program has four main modules: a layout editor, a schematic editor, an auto-router, and a CAM processor. Eagle runs all modules in a single-user interface. Therefore, you don't need to convert, for example, net lists between the schematic and layout modules. Other features are on-line forward and back annotation, context-sensitive help, and a powerful scripting language.

Price: Starts at DM 800.
CadSoft Computer, Pleiskirchen, Germany, +49 8635 810;
fax: +49 8635 920;
info@Cadsoft.de;
http://www.CadSoft.de.
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Real-Time Design of Shaded Models

CINEMA 4D, A 32-BIT RENDERING TOOL for the PC and the Power Mac, provides real-time modeling capabilities of shaded models. The software can handle extensive scenes with more than 100,000 faces, including optimized antialiasing. The XL version of Cinema 4D supports multiprocessing on up to four CPUs. The program's animation module features inverse kinematics, skeleton and hierarchy animation, object morphing, and real-time preview.

Price: DM 1500.
Maxon Computer, Eschborn, Germany, +49 6196 481811;
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http://www.maxon.de.
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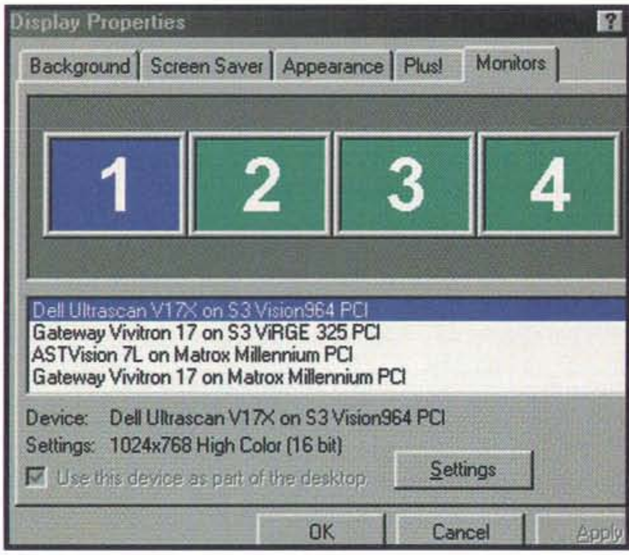
Memphis adds important features to Windows 95, including an overhauled TCP/IP stack. ***By Richard Cranford and Al Gallant***

Windows 95/Memphis: Ready for the Future



Dell Ultrascan V17X on S3 Vision964 PCI
Gateway Vivitron 17 on S3 ViRGE 325 PCI
ASTVision 7L on Matrox Millennium PCI
Gateway Vivitron 17 on Matrox Millennium PCI

Device: Dell Ultrascan V17X on S3 Vision964 PCI
Settings: 1024x768 High Color (16 bit)
☑ Use this device as part of the desktop

With two or more monitors, the system thinks it has one big monitor; Control Panel manages the displays handily.

Windows 95/ Memphis Developer Release

Price not determined at press time

Microsoft
Redmond, WA

206-882-8080
fax: 206-936-7329

http://www.microsoft.com

Enter 982 on Inquiry Card.

If you're looking for splashy new interface features, Microsoft's developer release preview of Windows 95/ Memphis won't satisfy: Those interface alterations are due later, when Internet Explorer 4.0 and the Windows shell and desktop improvements are plugged in. In the meantime, we took a look at the early stages of Microsoft's renovation of Windows 95, including some fancy new built-ins like support for multiple monitors; the Win32 Driver Model (WDM), which moves Windows 95 and NT toward driver compatibility; and an overhauled TCP/IP stack.

The keywords here are support, compatibility, and networking. Memphis incorporates all previous interim releases of Windows 95 and adds support for multiple keyboards and mice through the Universal Serial Bus (USB) interface. The new OS comes with technological goodies for third-party hardware, firmware, and software developers to exploit. Memphis promises support for the Advanced Configuration and Power Interface (ACPI), a power-management standard proposed by Intel, Microsoft, and Toshiba; and the OnNow Design Initiative, a system under which a computer might seem to be off but would be ready for immediate use when the power button is pressed or would "wake up" in response to some event such as an incoming phone call.

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★

Memphis is ready to use USB and IEEE 1394 (aka Firewire), the soon-to-be-ubiquitous digital versatile disc (DVD) devices, and a new 3-D graphics standard called Advanced Graphics Port (AGP). Enhanced Multilink Channel Aggregation lets you dedicate both ISDN channels of a basic rate interface (BRI) link to a single network connection. The result is faster (and we hope easier) ISDN hookups. Other improvements include control-panel scanner support, as well as support for the new wheel mouse, interfaces to asynchronous transfer mode (ATM) networks, and Telephony API (TAPI) 2.1.

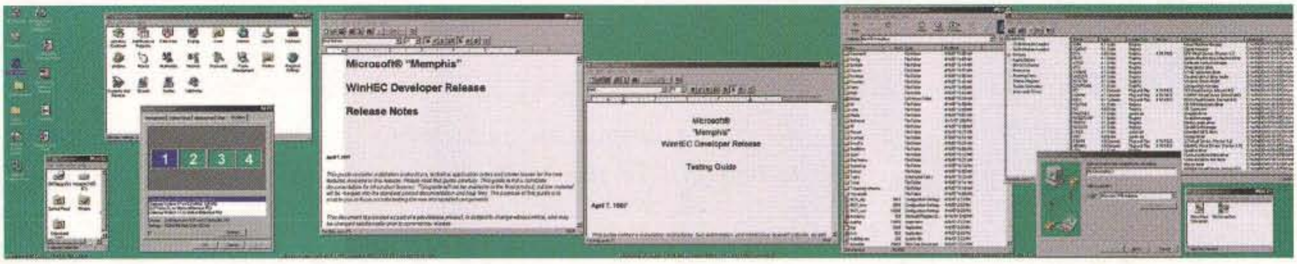
Also new in Memphis are a utility for storing the machine state when a software system fault occurs, a system file checker that can verify file integrity, a nifty system information utility, Windows scripting for direct script execution from the shell or from a command line, and Internet system updating to allow IS people to manage a system-configuration database by drawing directly from connected PCs.

The Internet Setup Wizard lets you configure the software and connection for any of the well-known Internet Service Providers, including CompuServe, AT&T WorldNet, America Online, and Prodigy. The Disk Defragmentation Optimization Wizard identifies the most commonly used applications and improves performance by putting all the files used by an application into the same area of the hard disk.

Quadruple Vision

One cool thing about Memphis is its ability to drive multiple monitors—up to four, in fact, if you've got enough slots for the extra video cards; eventually it will handle as many as nine. Of course, this capability is old hat to users of Macs and Unix workstations, but it's new to Windows users. An extra screen or two can boost productivity, especially for power users who quickly run out of screen real estate while working on a project that uses two, three, or more applications. Users who like to monitor e-mail and Web sites at a glance can still keep a full screen available for their current application.

Install two or more video cards in your



Microsoft® "Memphis"

WinHEC Developer Release

Release Notes

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"Memphis"

WinHEC Developer Release

Testing Guide

April 7, 1997

Memphis' multimonitor madness allows this desktop panorama to be broken up among four monitors connected to a single Win 95 PC.

PC, plug a monitor into each one, and your primary monitor will show your task bar, Start button, and desktop icons. Secondary monitors behave like extensions of your desktop, starting out empty except for your wallpaper or background. The monitor connected to the first video card is the home monitor, displaying desktop icons and the taskbar. You can move windows into the secondary monitors or even open up a window across monitors.

If a system has multiple PCI display adapters, the display control panel changes to reflect multiple monitors, showing not only the number and type but also the relative position. You control positioning by dragging the monitor symbol to a new or different relative location, so you can move monitors to the left or right, top or bottom, or even diagonally. If you lose track of which monitor is which while administering them, simply move the mouse pointer around and as it hits each monitor, the monitor number flashes on the active display (see the photo above).

While the prebeta Memphis we tested supports multiple display monitors, Microsoft supplied the needed secondary-display drivers for only a few PCI adapters: ATI Mach 64; S3 Trio, 764v+ (765), Virge, and Aurora; Cirrus Logic 5436, 7548, and 5446; Number Nine Imagine 128 I and II; Tseng Labs ET6000; and Matrox Millennium and Mystique.

TCP/IP Did a Job on Me

Microsoft has overhauled the Windows 95 TCP/IP stack, adding support for Winsock 2, IP Multicast, fast transmit and fast recovery, detection of address-assignment conflicts, long time-out intervals, and automatic address assignment. Point-to-Point Tunneling Protocol (PPTP) lets computers use the Internet as a virtual LAN. Previously available only on Windows NT Server and Workstation, PPTP enables secure virtual internetworking from the desktop.

Winsock 2 is a protocol-independent interface for network applications, providing support for network services such as real-time multimedia. Using the same sockets principle as BSD Unix, Winsock 2 (like previous versions) provides network applications with an interface to virtually any transport protocol, not just TCP/IP. New for Winsock 2 are protocol-independent name resolution, multicast and multipoint transmission, and quality of service (QoS).

Also new for the Memphis IP stack is the proposed Internet standard known as the Resource Reservation Protocol (RSVP), designed to enhance QoS. Hosts use RSVP to reserve network resources; RSVP handles reservations for unicast (one host to one host) and multicast applications, with the receiving host responsible for making reservations. All reservations are maintained in a soft state on routers.

Would Elvis Approve?

Elvis moved to Memphis, and so will practically everyone running Windows 95, eventually. The big question is when; Microsoft won't say, but it could be later this year. The developer release that we tested didn't crash unexpectedly, and it adds lots of nice new features. But we'll have to wait for Memphis to include Internet Explorer 4.0 (see "Microsoft's Free-Lunch Browser," June BYTE) and its desktop/Internet integration. **B**

Richard Cranford (**rcranford@aol.com**) *is a freelance writer in Cambridge, MA. Al Gallant is technical manager of the BYTE Lab; his address is* **al_gallant@mcgraw-hill.com.**

TECH FOCUS SECURITY

Virtual Tunneling Through the Internet

If users are connected to the Internet, and their intranet is connected to the Internet, you should be able to connect everyone in a virtual network. But using the Internet in this way to link hosts to corporate intranets is not sufficiently secure.

One solution is to use a protocol tunnel by generating a stream of packets that you want to send between the remote host and the corporate intranet, encrypting them, and treating the encrypted set of packets as data to be transmitted by a separate TCP/IP connection. When those packets (which actually contain the encrypted packets) arrive at their destination across the Internet, the receiving host decrypts them and handles them appropriately. Memphis will come with Point-to-Point Tunneling Protocol (PPTP), which you need for this type of security.

Protocol tunneling isn't new: Windows NT implemented PPTP last year. Other tunneling products include AltaVista's Tunnel 96 software, and many firewall vendors include tunneling options in their offerings. The big news is that PPTP's inclusion in Windows brings a widely deployed IP tunneling standard to the general user.

PPTP works by establishing a virtual adapter on the Windows client through the dial-up networking control panel. PPTP appears as a new modem type (the Virtual Private Networking Adapter), and the dial-up network wizard walks the user through the setup. When tunneling is enabled, a new IP default route is established and the "real" IP traffic is routed through the tunnel. When the tunnel is on, no other Internet hosts are visible, but once the tunnel is disconnected, the default route is removed and systems can be seen again.

Microsoft decided in May to release PPTP independently instead of waiting to bundle it with Memphis. You can download PPTP at http://www.microsoft.com.

Digital introduces a 266-MHz PC with a removable-motherboard design and plenty of configuration options. ***By Al Gallant***

Upwardly Mobile 3-D Workstation

Digital 266i Personal Workstation
$5200
(single CPU;
dual CPU, $6600)

Digital Equipment Corp.
Maynard, MA

800-344-4825

http://www.digital.com

Enter 1008
on Inquiry Card.

The 266i represents Digital's low-cost Windows NT 3-D workstation.

Digital Equipment brings some worthwhile engineering to its first dual-processor, high-end workstation, the Personal Workstation 266i. Competitively priced and a solid performer, the unit offers some intriguing new design features.

The most compelling feature of the 266i is the clever layout of its system boards. Its single motherboard has two components that allow a simple upgrade path to future versions of Digital's Alpha PC processor. The first board, which is stationary, contains power, ISA, PCI, and IDE components. The second board houses the processor and memory. You can swap it out without tools and easily plug it into the other board.

Digital offers both dual and single 266-MHz Pentium II processors; I tested the two-processor model. The BYTEmark CPU results were identical to those of the Intergraph TD-225 dual Pentium II system: 3.77 for the integer index and 4.45 for the floating-point index (see "3-D Price Breakthrough," June BYTE). The BYTEmark is not designed for multithreading, so test results will compare closely to a single-processor system.

The swappable processor board easily snaps onto the motherboard.

The 266i comes with an integrated 10/100 Ethernet card and a sound card. These cards do not take up PCI or ISA slots—a unique feature, as far as I know. Instead, these small cards sit away from both motherboard components, leaving additional room for five slots: three shared PCI/ISA slots and two PCI slots. This scheme lets you use five slots entirely for PCI boards or a combination of ISA and PCI boards. It can ease the transition from ISA to PCI as new PCI peripherals become available. Hard drive options are plentiful, with standard configurations allowing for any combination of the 2.1-GB IDE drive along with 2.1-, 4.3-, and 9.1-GB Wide UltraSCSI drives.

I tested the 266i's high-end PowerStorm 4D40T video adapter using two industry-standard OpenGL 3-D benchmarks. The first one included the CDRS viewset test, which is based on Parametric Technology's modeling and rendering software. Second, I used the DX viewset, which is based on IBM's Visualization Data Explorer. With a CDRS score of 15.88 and a DX score of 4.08, the 266i outperformed the higher-priced workstations that BYTE reviewed in December 1996 ("Affordable 3-D Workstations"). But it scored lower than the Intergraph TD-225, which came with a $1999 Intergraph Intense 3D 1000 video adapter.

Prices for the 266i start at $5200 for a single-processor system and $6600 for the dual-processor model. Optional large monitors, high-end video adapters, and large SCSI drives can push the price over $10,000 quickly.

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★
PERFORMANCE	★★★★

Although comparably equipped PCs for under $10,000 have begun to emerge, the 266i represents a competitive initiative by Digital to produce an affordable Windows NT 3-D workstation. The system's processor-board design is compelling. Anyone who has struggled to swap out a motherboard will appreciate its ease of use. Large-volume purchasers will find Digital's approach to upgrading an economical bonus. **B**

Al Gallant is the technical manager of the BYTE Lab. You can reach him at **agallant@bix.com.**

PHOTOGRAPHS: LIGHTWORKS PHOTOGRAPHIC © 1997

The latest WordPerfect Suite offers faster performance and better integration. By Stan Miastkowski

Corel's Nearly Perfect Suite Spot

My dad drove Chevrolets, my uncle drove Fords, and my eccentric maiden aunt drove an Austin. It's not much different with software suites; users tend to develop strong personal attachments. Microsoft continues to grab most of the suite market with Office, but Lotus's SmartSuite is still there, and Corel has been busy. With the release of WordPerfect Suite 8, the real news is how much work Corel has done to integrate components and boost performance.

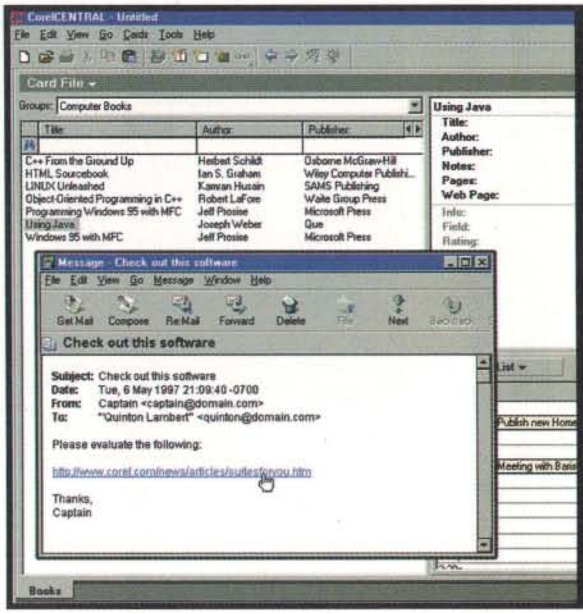
I looked at an incomplete beta version, with new versions of WordPerfect, Quattro Pro, Presentations, Envoy, and a handful of other applets. New in the suite is Barista, an application that creates Web pages from suite-generated documents, spreadsheets, and presentations.

Later in the year, users will be able to download Corel Central, the company's intriguing answer to Office 97's Outlook. Corel Central will include calendaring, scheduling, to-do lists, an address book, a contact log, and a card file. It will integrate with Netscape Communicator.

Dedicated WordPerfect fans will find much to like in WordPerfect Suite 8. The basic interface remains familiar, and the package's file formats haven't changed. Corel has focused on a few useful additions. For example, WordPerfect now has a drawing layer that, among other things, lets you overlay graphic objects on top of text. Table features are easier to use. Also, WordPerfect now supports Standard Generalized Markup Language (SGML), an international standard used by many government agencies and corporations.

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★
PERFORMANCE	★★★★★

Other components get their fair share of new features. Most notable in Quattro Pro is a QuickCell feature that lets you track changes to crucial cells as values change throughout the spreadsheet. Presentations can now package slide shows for easy distribution on floppy disks or as e-mail attachments. All the applications have extended Web functionality with HTML and Java support.



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Corel Corp.
Ottawa, Ontario, Canada

613-728-8200
fax: 613-761-9176

http://www.wordperfect.com

Enter 976 on Inquiry Card.

Corel Central, the new PIM that integrates with Netscape Communicator, will be an important part of WordPerfect Suite 8.

Prior versions of WordPerfect Suite showed the results of cobbling together a bunch of disparate applications, but Corel has changed that. The company has done an excellent job of making it a truly integrated package while retaining the distinctive flavors of the individual parts.

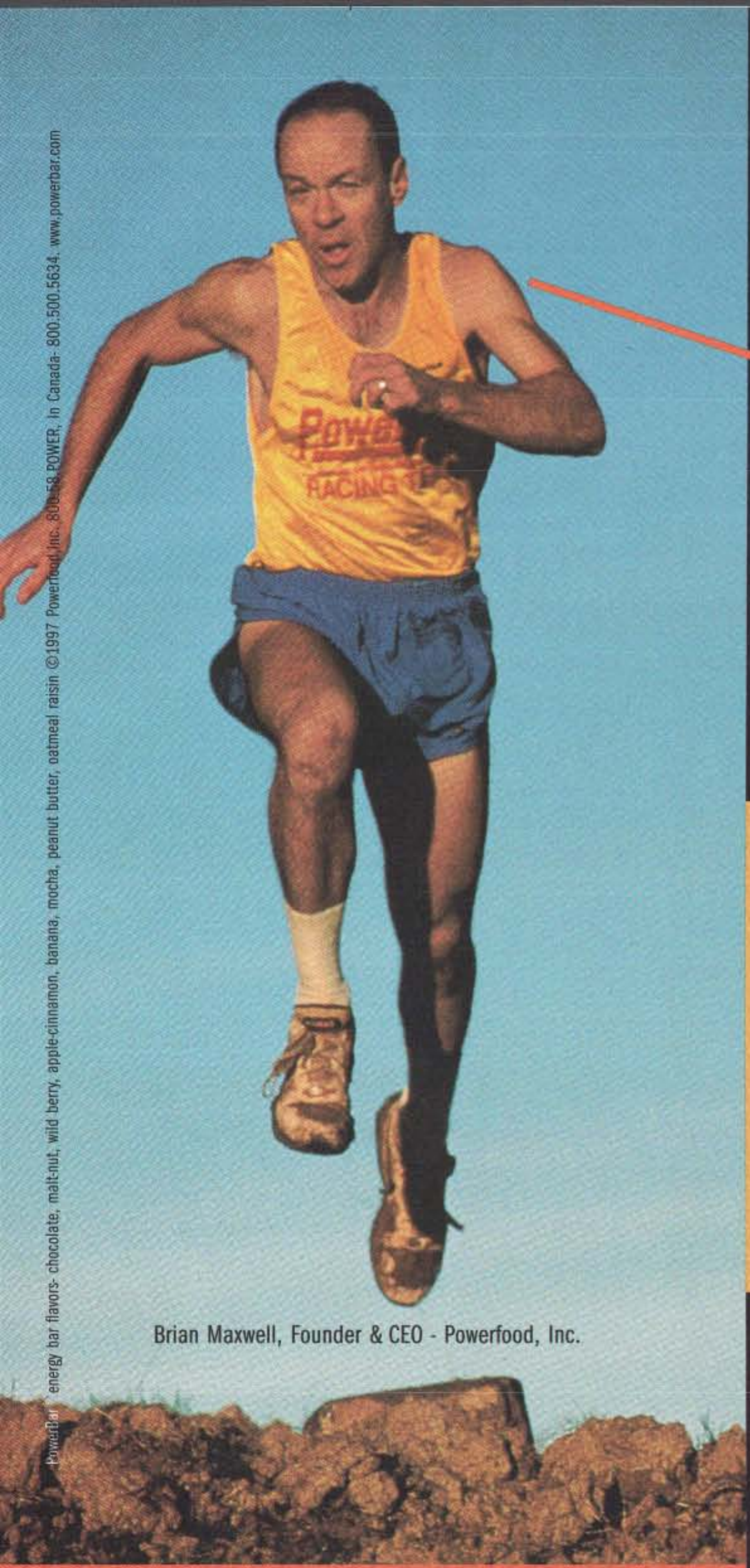
PerfectExpert—a new suite-wide, interactive, task-specific help system—allows you to ask plain-language questions and makes extensive use of wizards. And you won't find any cutesy on-screen characters, such as Office 97's dancing paper clip. PerfectExpert is all business.

Even in this beta version, it was obvious that the individual applications ran noticeably faster than in prior versions. Corel has obviously spent much time optimizing code. And increased use of shared code across the suite means that the shipping version will take less disk space and use less memory than version 7. That's the exact opposite of the competition. Also new is multimedia-extensions (MMX) technology support.

Later this year, Corel will release a new "professional" version of WordPerfect Suite that's more tuned for networked users. It will include updated versions of Paradox and Corel Time Line, Corel Central, a new application called Web.Sitebuilder, and other goodies. B

Stan Miastkowski is a BYTE consulting editor. You can reach him at **stanm@bix.com.**

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor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Single-client license	33.98
Windows NT Workstation V4.0	
Version upg CD	129.53
Single-client upg	239.98
Full version CD	279.87

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10-user CD	1316.20
25-user CD	2309.55
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3C905 Fast EtherLink XL PCI 10/100BT	95.90
OfficeConnect 8-port hub	119.35
SuperStack II Hub 12-port 10BT	506.02
SuperStack II Hub 24-port 10BT	866.77

Cisco Systems

MicroWeb 100 server	799.40
Catalyst 1900 24-port 10BT 2-port 100BT	2896.15
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COMPAQ

Netelligent 10BT PCI controller	91.85
Netelligent 10/100BTX PCI controller	99.78

Dayna

CommuniCard 33.6 data/fax modem	189.27
CommuniCard PLUS 10BT/33.6 Ethernet/modem	344.76

LINKSYS

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Combo EtherPCI LAN card	65.70
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NETGEAR

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FE104 4-port 100BT Fast Ethernet hub	188.58
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Seagate Software

Backup Exec V6.11 for Windows NT	
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Enterprise edition	809.01

SMC

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EtherEZ 8TC 10BT hub	129.83
EtherEZ 16TC 10BT hub	279.88
EtherEZ 10BT ISA	92.82
EtherPower 10/100BTX PCI	72.08

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LANLinker switched 56 router	729.24

Xircom

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Ditto Easy 800MB Travan external	149.95
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Jaz drive 1GB external SCSI-2	399.95
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Ditto Dash Card	59.95

PHILIPS

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EasyWRITER CD recorder external	799.00

SyQuest

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Motorola Mariner 33.6	349.54
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U.S. Robotics 33.6 cellular w/XJACK	229.95
U.S. Robotics 33.6 w/XJACK	219.00
Xircom 33.6	224.96
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OPTIMA 336 Business Modem external	236.48
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LEXMARK

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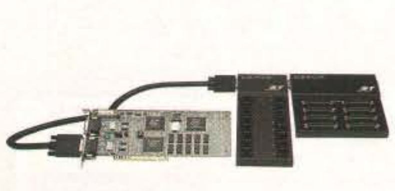
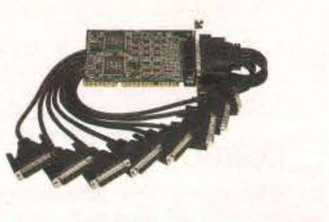


SST-128 PCI board shown with 16-port RJ-45 and 8-port DB-25 Port Module



SST-8 ISA board with 8-port DB-25 fan-out cable attached

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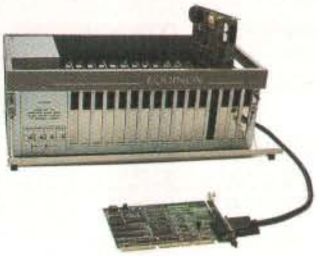

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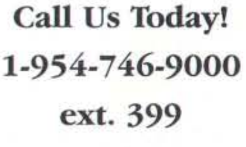

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Simware's Salvo lets you use Web standards to operate mainframe databases. By Alexa Bielefeld, Rick Martin, and Brian Wachter

Using the Web with Legacy Databases

Until recently, connecting to a mainframe from the desktop meant terminal emulation and a dedicated network infrastructure, with all their inherent limitations. You obtained connectivity to character-based legacy applications and the data behind them through the "green screen" and nothing more.

Simware's Salvo provides more than the ability to capture terminal data (known as "screen-scraping"); it enhances legacy applications without requiring any modifications on the mainframe side. Salvo's development framework uses *information objects* that separate the information's presentation from its underlying location and logic.

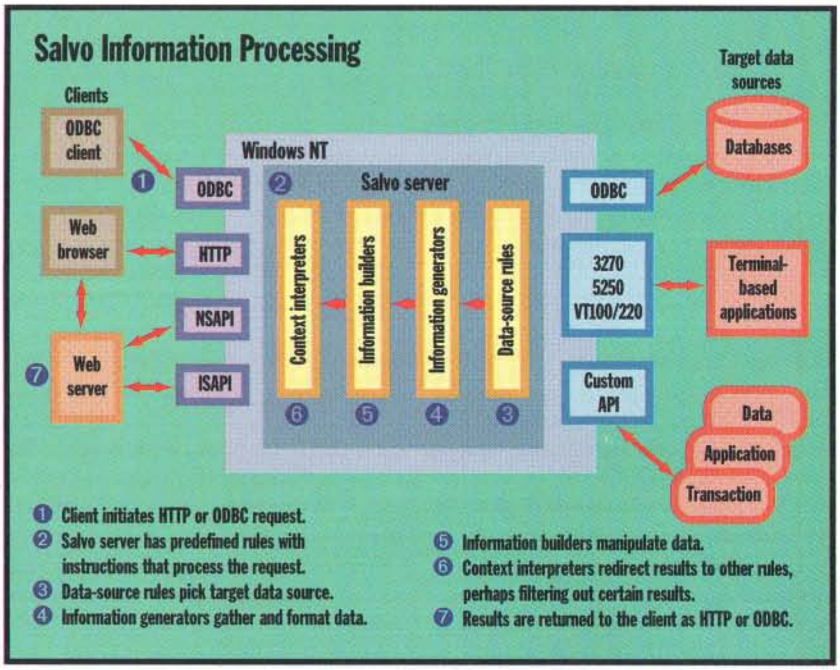
Salvo Components

The core of Salvo is its server component, which runs on Microsoft Windows NT Server 3.51 or higher. Using a GUI, developers create *information rules*, which allow for a user to access data sources and manipulate their information. These rules let you create information objects for inclusion in applications.

Since Salvo's development environment uses HTML, all the information-object-programming tasks can be done via a Web browser. The resulting objects present information to users via an HTTP- (i.e., Web browser) or ODBC-compliant (i.e., stand-alone) container. Simware is working to provide hooks into Salvo for Common Object Request Broker Architecture (CORBA) and Component Object Model (COM) object technology. Client applications can be written in any tool that supports ODBC, such as PowerBuilder, Visual Basic, and Visual Basic for Applications (VBA).

Data sources that can be unified into an application developed with Salvo include 3270, 5250, VT100, and VT220 terminal-based applications, as well as ODBC data sources. Salvo 3.5 ships with drivers for Informix, Ingres, Microsoft SQL Server, Oracle, and Sybase ODBC sources. Drivers for other vendors' products can be acquired from the individual vendors.

For a relational database, the data source name and a connect string are specified in the Salvo interface. For a terminal-based application, for example, an IP address and a port number to your TN3270 server, an emulation type, a screen size, and a code page are specified. Code-page support provides multilanguage capabilities for mainframe applications. You need not have TCP/IP installed on your mainframe computer to take advantage of Salvo: It works with SNA-to-TCP/IP gateways, such as Microsoft's Systems Network Architecture (SNA) Server. All users of the finished application need a user ID and a password. Group access can also be defined.



Salvo Information Processing

① Client initiates HTTP or ODBC request.
② Salvo server has predefined rules with instructions that process the request.
③ Data-source rules pick target data source.
④ Information generators gather and format data.
⑤ Information builders manipulate data.
⑥ Context interpreters redirect results to other rules, perhaps filtering out certain results.
⑦ Results are returned to the client as HTTP or ODBC.

Data from terminal-based legacy databases can be transformed by user-defined rules into HTML pages.

Dealing with Data

After defining the "what" (the data source) and the "who" (the user), you construct the "how" (the rules). You define information rules that regulate access to data and generate information objects. Information rules come in three flavors: information generators, information builders, and context interpreters.

An *information generator* is required for each data source that the application accesses. It can be redefined as necessary in the editor, allowing the application to follow data sources as they migrate from one platform to another. Information generators can also operate independently of data sources to run an algorithm, read from a file, or return static text.

Information builders handle processing instructions. They work on the information object tables created by information generators. Some examples of operations that can be performed on a table include the following:

- join or union
- sort or filter data
- arithmetic calculations
- delete columns or tables

The *context interpreter* redirects a request to the appropriate information rule, based on the context of the particular request. The context might concern the user or user group that generated it, or the date and/or time of the request. Users see results that are tailored to include only the host or ODBC data defined by the developer.

The strength of the information object model lies in its modularity. Information rules can be individually developed and tested and then integrated into a complete application. Information rules are stored in an information object repository, where they can be used and reused.

For Web clients, Salvo's information objects are displayed via a default HTML template. Information rules can invoke a custom template or server-side script. These custom actions are specified or modified when you create the object's corresponding information rule. Scripts currently must be written in Rexx; however, Simware is working on VBScript and JScript implementations.

Another of Salvo's strengths is that it gives developers lots of control over where their scripts live. For security, all scripts that return log-on data can be hidden from the client. If the goal is to move the computing burden to the client, scripts that generate complex GUI elements can reside inside the template that runs on the client.

Server-side scripts can be either written using an integrated editor or written on an external editor and then copied into Salvo. Sample code is provided to ease script creation. In a template, standard HTML features, such as check boxes, radio buttons, and text-input fields, can be used to generate output that the Salvo server directs to the appropriate information rule. Also, any scripting language supported by the client browser, such as JavaScript, JScript, and VBScript, can be used by the template to analyze or modify content or to alter inputs or outputs. These instructions are transmitted via a CGI stream carried as a standard server request, just like a URL typed into a browser's location field.

WHERE TO FIND

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Capturing a Screen

```
<FORM METHOD="POST"  ACTION="salvocgi.exe">
<INPUT TYPE="hidden" NAME="Request" VALUE="Connect">
<INPUT TYPE="hidden" NAME="ScriptName" VALUE="_btInit">
<INPUT TYPE="hidden" NAME="DDM.TN3270.Host name or address"
VALUE="000.00.000.00">
</FORM>
```

For example, to convert a 3270 screen into HTML without calling an information rule—the quick-and-dirty way to "scrape" a 3270 screen—a CGI data stream is placed between HTML FORM tags that generate a server request for a connection, as shown in the listing "Capturing a Screen" above. The inputs are hidden because there's no user interaction. The `ScriptName` input contains the name of the script that initiates the session—in this case, one that comes preloaded in Salvo.

Templates use the `SalvoImport` tag to define how the tables in an information object are transformed into HTML, as shown below:

```
SalvoImport(tablenumber,rowspec,
  colspec)
```

The first nested value, `tablenumber`, is the number that specifies the position of the table in the information object (e.g., if the result set has only one table, then `tablenumber` equals 1). The second value, `rowspec`, is a specification of the position of the row(s) in the table. The number can be either a row number or a row definition. A *row definition* can be a range of rows or a combination of ranges of rows and row numbers (e.g., 2, 4–6, 8–10). The last value, `colspec`, is a specification of the position of the column(s) in the table. The number can be a column number or a column definition whose syntax is identical to `rowspec`'s.

Legacy Support

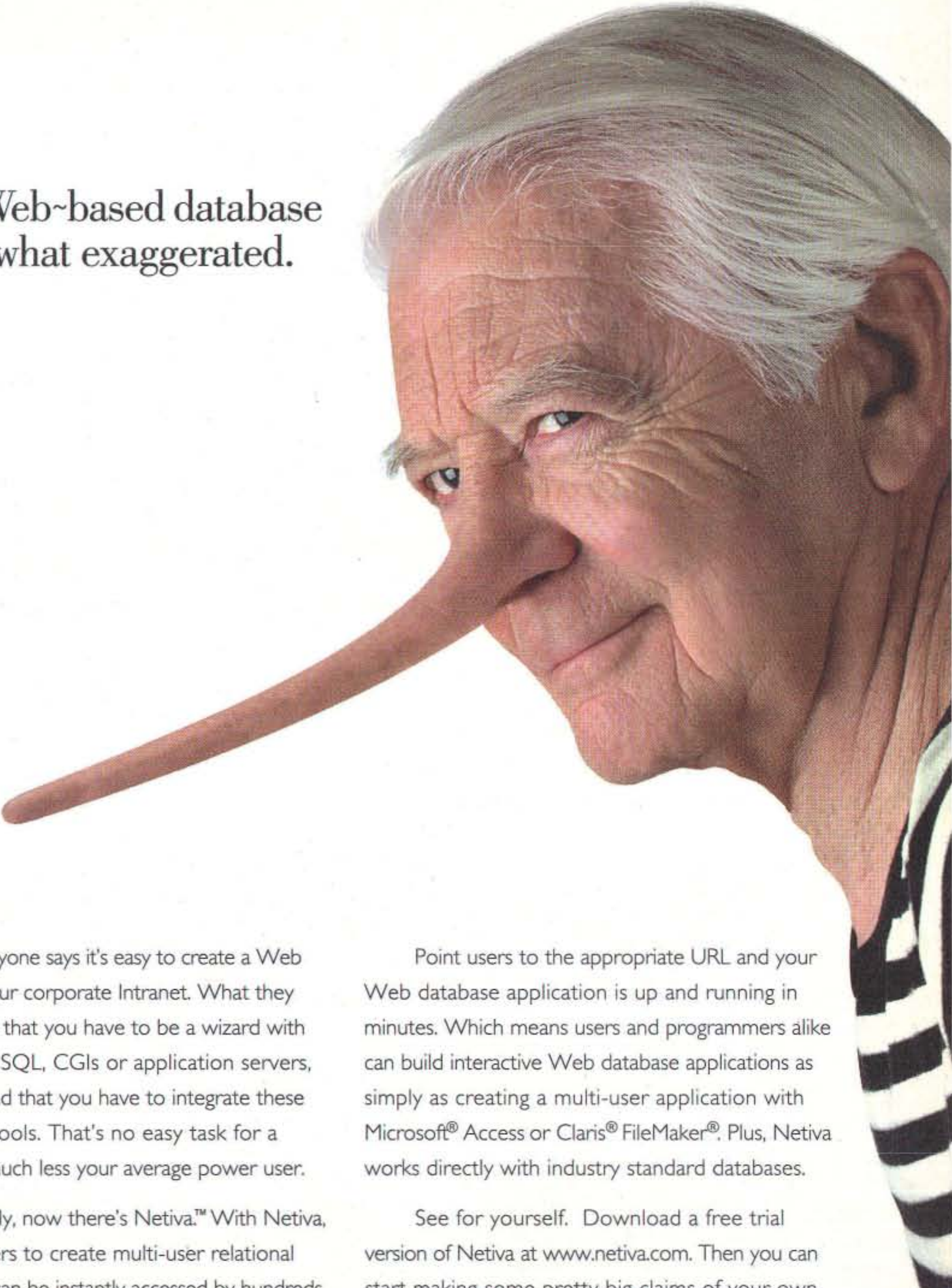
Salvo helps eliminate the inflexibility of legacy applications, allowing developers to meet the constantly changing requirements of their users. If the goal is, for instance, to provide a remote user with only certain screens in a data-retrieval program, the old model required developers to modify the legacy application in COBOL (or whatever its native coding environment was). Salvo changes this model by using HTML, server-side scripting, and information rules. By taking advantage of Salvo's ability to make HTML pages out of terminal screens, a programmer can use the context-interpreter information rule to control access to specific pages (i.e., screens). Salvo also adds the ability to deliver data from ODBC data sources, which are integrated with the legacy application data, to the client.

Other tools for Web-centric host connectivity on the market today include OpenConnect's OpenVista, which allows developers to create custom Java applets. Of course, the applets require a Java Virtual Machine (VM) to execute.

Salvo 3.5 provides the framework for a new generation of Web-centric applications. With its ability to integrate data from divergent enterprise environments and to leverage current development tools and standards, the Salvo model could prove to be the legs that keep legacy systems moving into the twenty-first century. **B**

Alexa Bielefeld, Rick Martin, and Brian Wachter are Internet technology specialists working for Computer Systems Development, Inc. (Albuquerque, NM), an IT consulting firm. You can reach them at **Alexa.Bielefeld@CSDinc.com**, **Rick.Martin@CSDinc.com**, *and* **Brian.Wachter@CSDinc.com**, *respectively.*

Until now, claims of Web-based database ease have been somewhat exaggerated.



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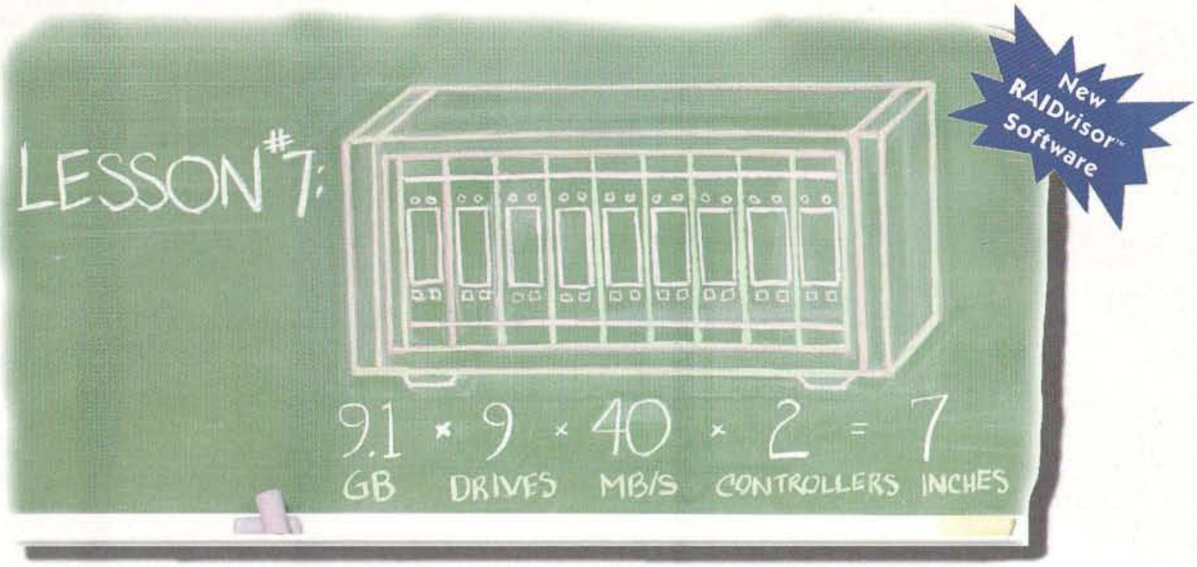

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Low power consumption and high performance make Hitachi's SH-3 processor ideal for hand-held devices. ***By Lyle Supp***

The Heart of Hand-Held PCs

Until recently, personal-access products such as PDAs have met with limited success. Among their problems have been incompatibility with the user's existing desktop PC databases, very limited performance, and limited capabilities. However, with recent advances in processor technology and the appearance of OSes crafted for personal-access markets (e.g., Windows CE), the limitations of such products are diminishing.

The processors that drive these new personal-access products must accommodate a demanding array of system requirements. High performance and throughput are necessary for them to run complex Windows-type OSes. They must be small, so that vendors can build compact systems. A low cost is necessary, so that companies can price these systems competitively. Finally, low power consumption to extend battery life and reduce the overall operating cost is a primary concern.

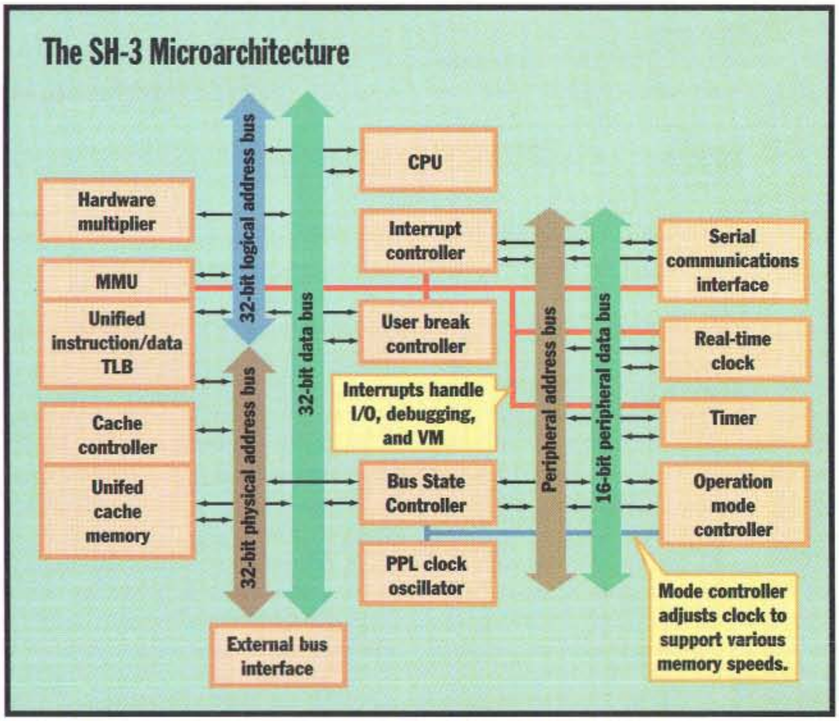
A Tour of the SH-3

Hitachi developed the SH-3, its latest 32-bit RISC processor, to address the demanding requirements of emerging products such as hand-held PCs (HPCs). The company based the SH-3 on its SuperH RISC architecture, which has a large, uniform logical address space and a high-level-language orientation. The SH-3 is a pipelined implementation of the SuperH architecture with a large onboard cache, memory management unit (MMU), and software-programmable power management functions.

The first two members of the SH-3 family, the SH7702 and the SH7708, are housed in a 120-pin Plastic Quad Flat Package (PQFP) and 144-pin PQFP, respectively. Both processors are fabricated using 0.5-micron CMOS technology. Because the CPU core size consists of less than 6 mm^2 of the overall 43 mm^2 die size, the rest of the die is used for on-chip memory and peripheral support, as shown in the figure "The SH-3 Microarchitecture" below.

At the heart of the SH-3 is the SuperH RISC engine. It has a five-stage pipeline with a hardware multiplier, 32-bit internal data paths, and 25 32-bit registers (i.e., 16 general-purpose registers, five control registers, and four system registers). The SH-3's engine manages a 4-GB, byte-addressable, unsegmented physical address space.

A 16-bit fixed instruction length offers significant code efficiency over 32-bit fixed-instruction-length processors of 40 percent to 60 percent, and 60 percent compared to conventional variable-instruction-length processors. An execution rate of one instruction per cycle, combined with fast clock speeds of 60 MHz (100 MHz in future releases), lets programs run quickly and efficiently.


The SH-3 Microarchitecture
32-bit logical address bus
32-bit data bus
CPU
Hardware multiplier
Interrupt controller
MMU
Unified instruction/data TLB
User break controller
Interrupts handle I/O, debugging, and VM
Cache controller
Unifed cache memory
32-bit physical address bus
Bus State Controller
PPL clock oscillator
External bus interface
Peripheral address bus
16-bit peripheral data bus
Serial communications interface
Real-time clock
Timer
Operation mode controller
Mode controller adjusts clock to support various memory speeds.

The SH-3 processor has a powerful RISC core, virtual memory support, and ample I/O interfaces.

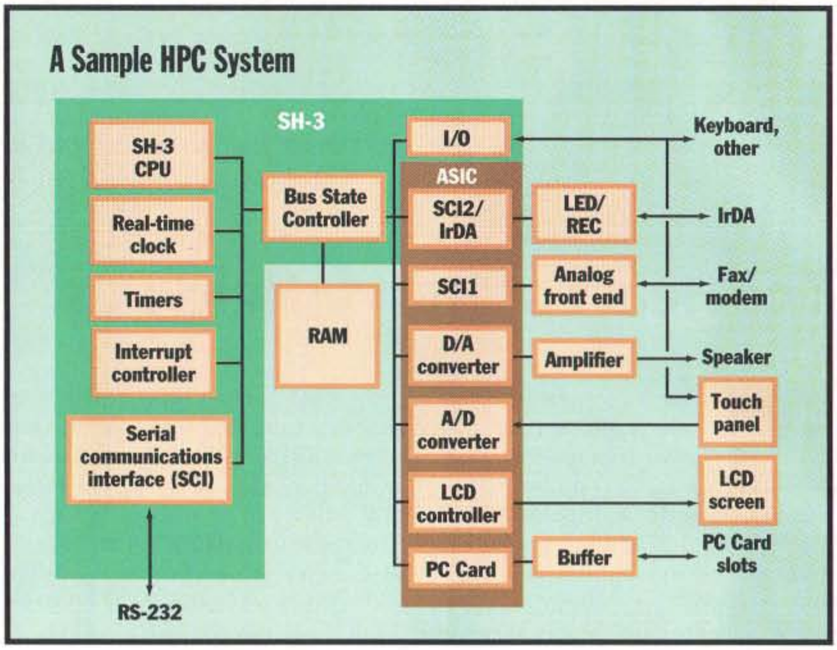
A primary determinant of overall processor performance is the size of the on-board cache. The SH7708 integrates a full 8-KB four-way set-associative cache. An MMU with a resident 128-entry translation look-aside buffer (TLB) handles the efficient management of on- and off-chip memory and reduces power consumption. The MMU uses Address Space Identifiers (ASIDs) that implement memory protection during multitasking with multiple virtual memory modes. Thus, each process has its own virtual memory and is prevented from accessing the resources of another process or the OS kernel. To manage the varying requirements of complex OSes, the MMU's address translator uses a paging system that supports either 1- or 4-KB page sizes for efficient main-memory management.

The SH-3 also features a Bus State Controller (BSC). The BSC allows direct connection with various external memory components such as DRAM, static RAM (SRAM), synchronous DRAM (SDRAM), pseudostatic RAM (PSRAM), and ROM to minimize external logic and cost. The 32-bit external bus consists of 26 address lines and seven predecoded chip selects. These are configurable, so that the SH-3 can use the appropriate clock speed (i.e., one-fourth, one-half, or system clock speed) for the type of memory accessed, on an area-by-area basis in the physical address space. You can also specify bus wait states. The 32-bit width of the bus provides enhanced performance over narrower 16-bit configurations, although the designer can configure the bus for 16-bit operations.

The SH-3 offers support for a large number of on-board peripherals with a 32-bit three-channel timer, a real-time clock (RTC), an integer multiplier-accumulator, a barrel shifter, a user break controller for on-chip debugging, and serial communications with a smartcard interface, per the ISO 7816-3 specification. The SH-3 also directly supports a PC Card controller interface. This lets the SH-3 manage up to two Type II PC Card slots.

To address low power consumption, even during high-speed operation, the SH-3 features some built-in power management functions. The first category of such functions is software-controlled power management. Three power-reduction modes—sleep, standby, and module standby—are supported. In sleep mode, the CPU core stops operating while other functions remain active. In standby mode, an RTC maintains key system data while the CPU core and peripherals are powered off, enabling current consumption of less than 4 microamperes (or 1 μA if you don't use the RTC). In module standby mode, the CPU remains active while idle peripheral modules are disabled until needed.

Because the cache and TLB account for about one-third of total power dissipation, the SH-3 also deploys three hardware power management schemes aimed at reducing cache power dissipation. The first scheme has only one of four cache data arrays powered when the operating frequency is sufficiently low for sequential operation (less than 40 MHz). Above this frequency, the four data arrays operate in parallel.


A Sample HPC System

The SH-3, combined with a companion ASIC, provides a glueless interface to many HPC system functions.

The second scheme, termed the pulse-word technique, restricts the voltage swing of the word line so that it is narrower than a full V_{CC}-to-ground swing, but wide enough for correct sense-amplifier operation.

The third scheme is called the isolated bit-line technique. In it, column switches are placed on bit lines between memory cells and latch-type sense amplifiers. These column switches reduce sense-amplifier loads by isolating parasitic capacitance of the bit lines from the active sense amplifiers.

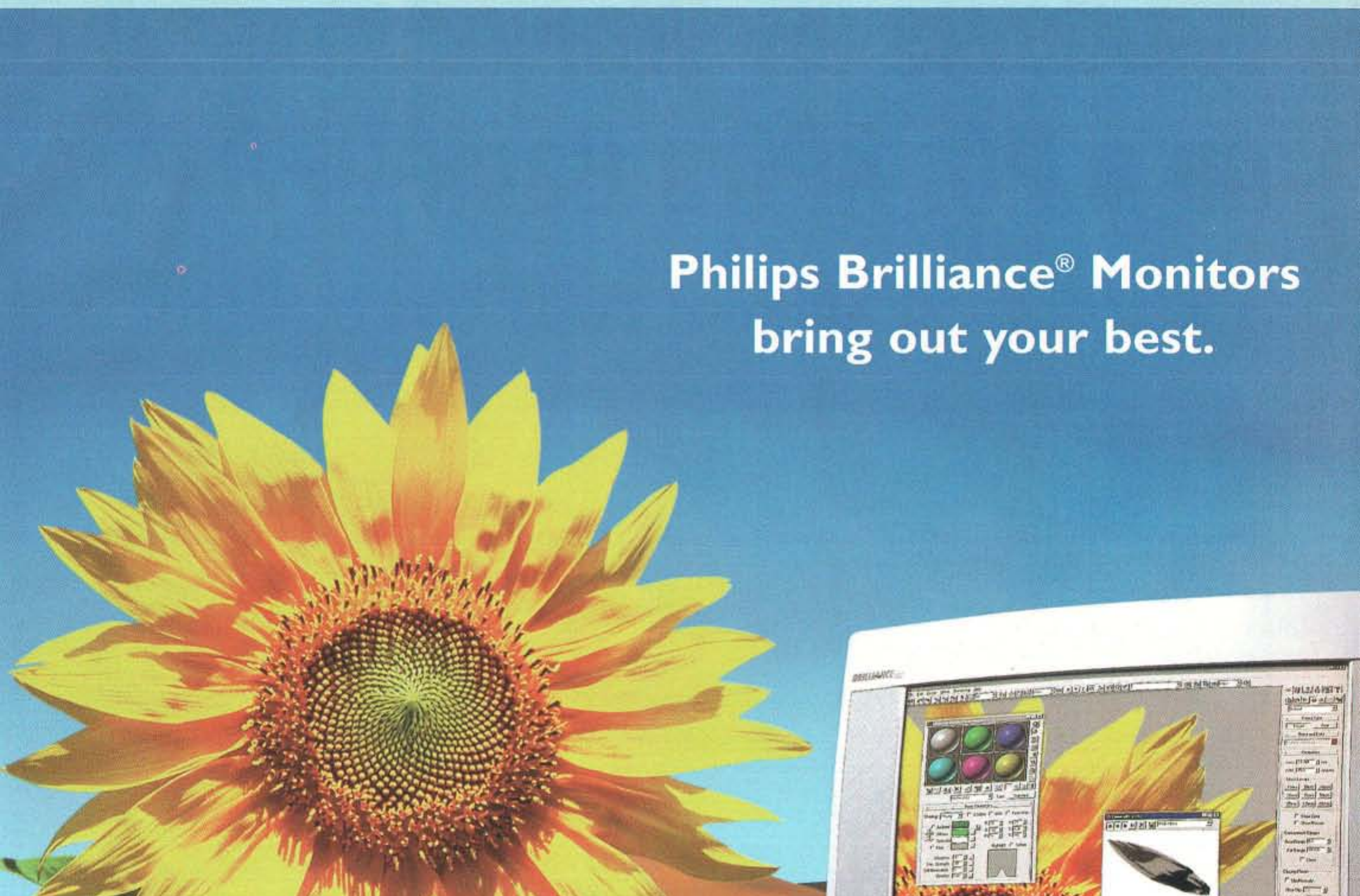
Glove-Fit for HPC

The capabilities of the SH-3 map particularly well into HPC applications. For cost-sensitive and power-sensitive HPC applications, the 100-MIPS (Dhrystone benchmark) performance of the SH-3 makes it a practical solution. The SH-3's 32-bit architecture with 16-bit fixed instruction set efficiently supports advanced applications and complex data types required by HPC users. Hitachi designed the MMU functions, such as variable page size, ASID support, and cache size, to ensure optimum operation of leading OSes such as Windows CE.

The advanced power management capabilities of the SH-3 provide for very low power dissipation. At 100 MHz, the SH-3 dissipates 700 milliwatts. The SH-3's broad spectrum of on-board peripheral support (as shown in the figure "A Sample HPC System" above) facilitates a small HPC system size, reduced parts count and cost, and low power consumption. The large volume of processors that Hitachi produces makes it possible to price the SH-3 below $25 per unit, in lots of 1000.

The suitability of the SH-3 processor for HPC applications is evidenced by the fact that it was designed into five of the seven Windows CE HPCs that were announced at Comdex last year, as well as several traditional HPCs and high-end PDAs, such as Sharp's Color Zaurus. With its on-chip MMU, extensive peripheral integration, and power-conservative design, the SH-3 provides powerful enabling technology for emerging personal-access products. B

Lyle Supp is a product marketing manager for RISC MPUs/MCUs at Hitachi America, Ltd., Semiconductor and IC Division. You can contact him at **lyle.supp@halsp.hitachi.com.**



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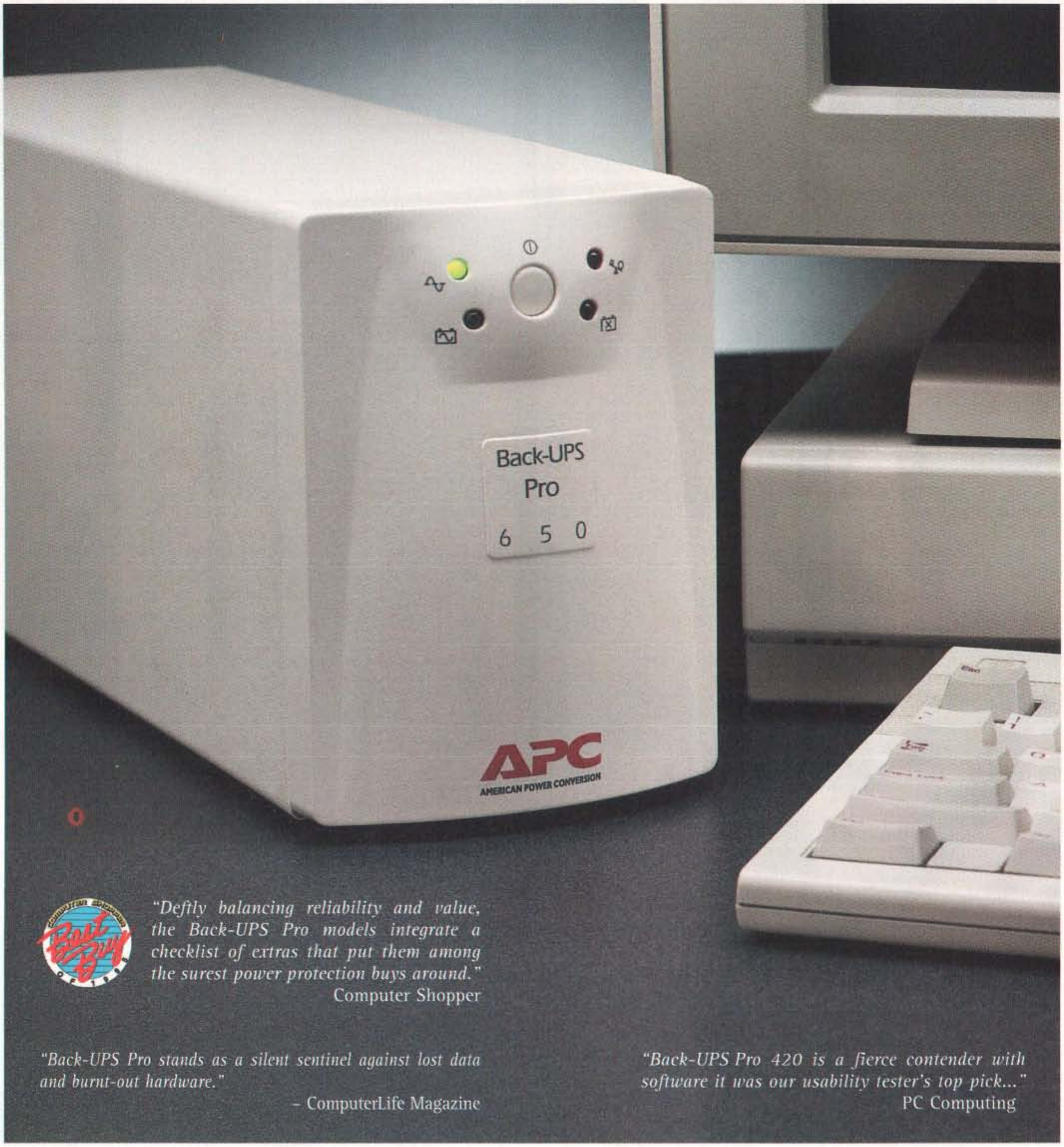

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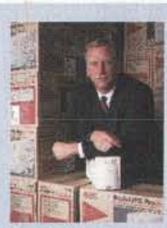

Michael Mullicane, CIO for America II Group, the 17th fastest growing company in America according to Inc.'s 1994 list says, "It's a no-brainer to protect servers, but we learned that it was crazy to bog down our MIS staff with client-related downtime and data loss when an APC UPS is such a cost-effective solution. Now we properly protect every single workstation in our entire global network... At the bottom line, having a standardized desktop environment that includes a fully integrated APC UPS is key to providing reliable information access to our employees, and that's what we're all here for."

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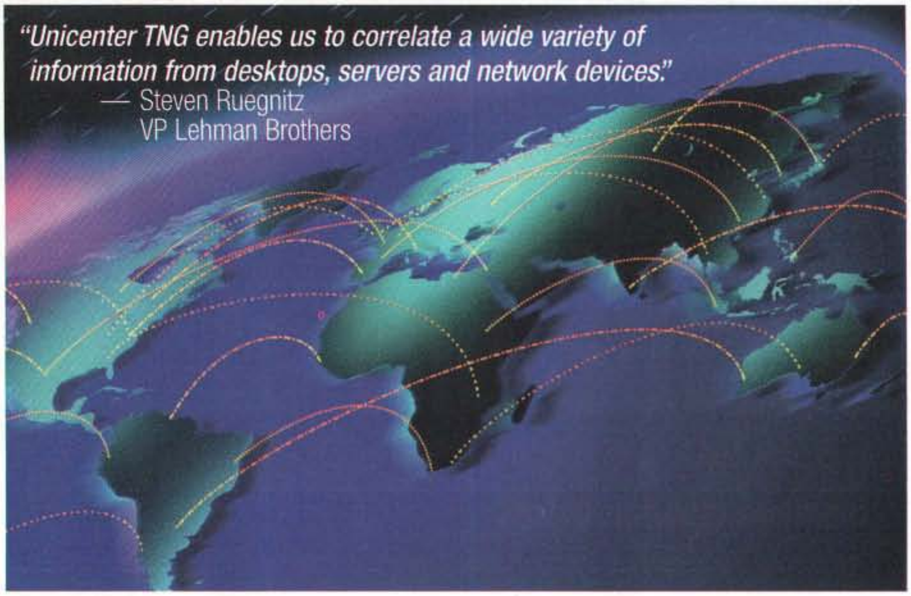

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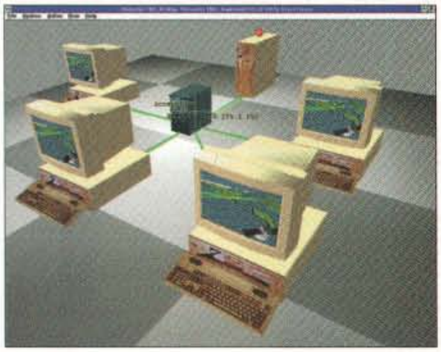

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Core Programming

With frameworks across the Mac, Unix, and Windows, could Apple's OS become the best development platform? ***By Justin Morgan***

Concert's API Goes Cross-Platform

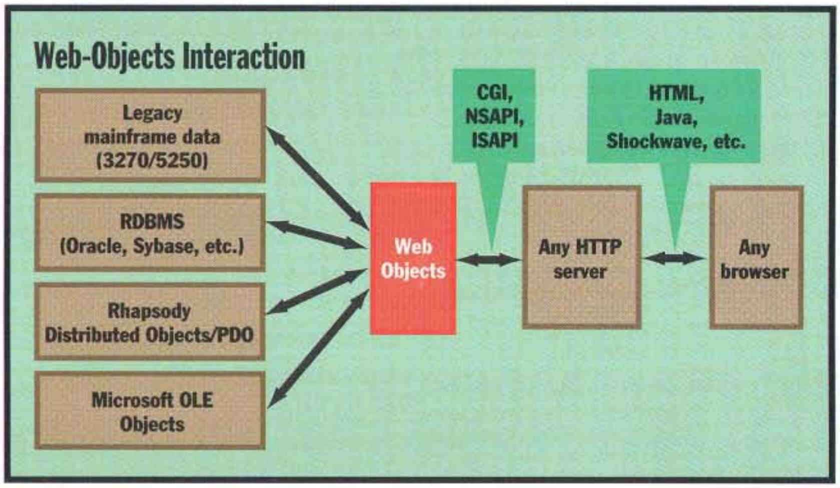
The foundation of Apple's Concert is Next Software's OpenStep, which was originally an open API designed for building cross-platform object-oriented programs. This specification was implemented by Next as a group of object frameworks and supporting tools that are analogous to the Microsoft Foundation Classes (MFC) and Metrowerks' PowerPlant library. Java's class libraries are similar to Concert's frameworks, but Concert applications run much faster because they are compiled.

Concert Everywhere

Concert (formerly called "Yellow Box") comprises a suite of tools and frameworks adapted for the Macintosh from Next's OpenStep products. OpenStep is the fourth iteration of NextStep, one of the most advanced development environments for the past 10 years. A large number of software developers have successfully leveraged OpenStep to quickly create custom applications for Fortune 500 corporations.

As a result, Next has refined its frameworks and tools to a sharp edge, and Concert has thus become one of the best environments for rapidly prototyping and deploying custom applications. Concert applications can be cross-compiled and deployed in a matter of hours for the next-generation Mac OS on PowerPC, for Windows NT and 95 on x86 processors, and for Sun's Solaris systems.

Unlike some cross-platform environments, Concert-built applications have the exact look and feel of the target platform. Thus, Macintosh applications written with Concert look and feel just like all other Macintosh applications. If the same Concert source code is compiled for Windows, then the resulting applications will feel and behave just like any other Windows applications.


Web-Objects Interaction
Legacy mainframe data (3270/5250)
RDBMS (Oracle, Sybase, etc.)
Rhapsody Distributed Objects/PDO
Microsoft OLE Objects
Web Objects
CGI, NSAPI, ISAPI
Any HTTP server
HTML, Java, Shockwave, etc.
Any browser

Web Objects can package any sort of data and export it as HTML for use in any Web browser.

Frameworks in a Nutshell

Concert's object frameworks do not ship with source code; they come with only headers and a library. But they can be extended by subclassing or through the addition of Objective-C categories (see "An Introduction to Objective-C," June BYTE). Also, each framework is abundantly documented and indexed, in both hard copy and on-line documentation. What follows is a review of each of Concert's major frameworks.

The Foundation Kit is Concert's central framework. This comprehensive kit includes core objects, such as `NSObject` (the superclass for all other classes), which all the other frameworks use. The Kit contains Concert's classes for collections, run loops, strings, numbers, exceptions, threads, dates, and many others. It contains no GUI-related objects; this allows developers to create programs that run from a command line, such as Unix daemons or command utilities.

The Application Kit is an extensive framework of classes for creating GUIs. These interfaces feature the exact look and feel of the target environment. The AppKit is based on several industry standards. For example, on-screen drawing is done using Adobe's device-independent Display PostScript. The text-related objects in Concert can emit formatted text using Microsoft's Rich Text Format (RTF) standard.

An innovative development tool, called Interface Builder (IB), works with "live" AppKit objects for rapid application development (RAD). With IB, developers can lay out an application's visual interface, graphically connect the visual objects using a target/action paradigm, and then test the application without recompiling. When the developer has got the right interface—after several quick iterations—the layout data is saved in a file. This file is later used as a resource when the application is compiled to build a stand-alone application.

The Web Objects Framework (WOF) is a tool for turning mission-critical data *into fancy, dynamic Web sites.* The WOF gathers data from any data source, such as a database or mainframe, and packages that data into objects. These objects run within server applications, and the objects know how to graphically represent themselves by emitting HTML. This allows any modern Web browser to act as the viewer for WOF applications. The figure "Web-Objects Interaction" on page 51 shows how the various software components of a Web Objects site relate to each other. Finally, Java development is also an integral part of WOF.

WOF works well within existing corporate environments by adhering to existing standards. The Web-based applications that it creates can contain frames, forms, and any other standard HTML constructs. In addition, security features, such as Secure Sockets Layer (SSL), S-HTTP, and firewalls, work with WOF.

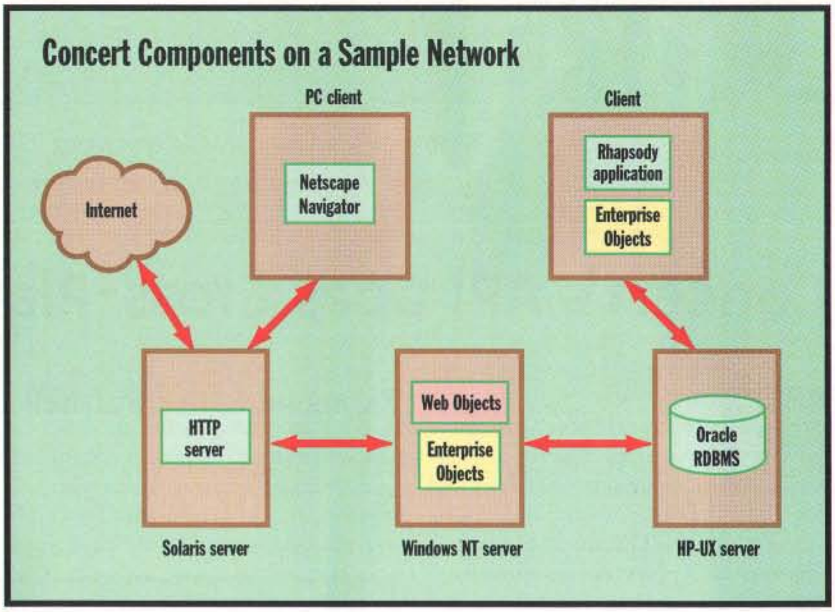
The Enterprise Objects Framework (EOF) provides object-oriented access to relational databases. EOF is a database-independent persistence API, and it works well as a persistence mechanism for Web Objects or any Concert application. Conceptually, EOF maps a DBMS table definition to a class. Each row in a table therefore represents an instance of that class.

EOF supports access to many vendors' databases by using an adapter that translates EOF's object-oriented application-level API calls to corresponding low-level Informix, Oracle, Sybase, or ODBC calls. EOF has an open, extensible architecture and can support any RDBMS/OODBMS; third parties are working on adapters that access other databases.

Distributed Objects (DOs) are an integrated part of Concert, but they don't belong to a framework per se—any class developed with Concert is potentially distributable. DOs offer a powerful mechanism for locating and accessing remote objects.

Concert's DOs are not CORBA-compliant, but Apple might add hooks to CORBA in the near future. In the meantime, Apple's Portable Distributed Objects (PDO) product allows objects to be compiled and deployed on all popular Unix variants. This lets such compute-intensive objects reside on high-powered servers and interoperate with any Concert object on a network.

Windows developers will be happy to learn that Concert tools on Windows support OLE connectivity via OLE Automation. Apple also offers a tool, called D'OLE, that works as a bridge between OLE and PDO. This pair of products makes OLE into a viable multiplatform distributed-object solution.



Enterprise Objects allow access to any database, and Web Objects enable clients to view them with a Web Browser.

Cross-Platform Development?

As this article illustrates, Concert allows developers to create and deploy solutions on the Mac, under Windows or Unix, or on any combination of these. Concert offers a wealth of tools and frameworks for building applications or Web sites that utilize existing databases. Furthermore, legacy systems can be easily integrated with Concert. The figure "Concert Components on a Sample Network" above shows some sample Concert components and the machines on which they would commonly run.

All this might seem like a programmer's nirvana, but there are still many remaining issues to be resolved before Rhapsody and Concert come to market. Probably the most visible problem for Concert developers is the learning curve for Concert frameworks. Learning Objective-C is easy and takes only a few days. Because of Concert's clear and intuitive interface, the development tools are easy to learn as well. However, acquainting one's self with the entire set of frameworks can take several months. Fortunately, developers generally need to learn and use only a subset of each framework.

Another issue is that it's hard to find experienced OpenStep developers. Apple's developer-relations department must strive to entice developers to learn Concert; otherwise, some corporations and independent software vendors will shy away from Concert because it's easier to find C++ developers. Apple can help by keeping the developer-entry costs low—a lesson that Next never learned.

Although Concert is already standards-based, Apple should strive to add standards compliance wherever possible. For example, developers would welcome a fully CORBA-compliant Distributed Objects system, or an Object Database Management Group (ODMG)–compliant option for database connectivity.

In the final analysis, these nits are insignificant in comparison to the incredible flexibility and power of Concert. Any developer who has used Concert will tell you that it's a compelling environment for anyone who wants to develop a single source base and then deploy it on the Mac, Windows, and Unix. Apple's Concert is clearly an excellent solution for almost anyone, even those who only do Windows. **B**

Justin Morgan has been programming OpenStep/NextStep since it was available only in a black cube. You can reach him at **jmorgan@objectronics.com.**

JavaOS uses a slim kernel that draws additional system services from servers on demand. ***By Charles Mirho and Tom Clements***

JavaOS: Thin Client, Fat Service

During the first part of this decade, fat clients prevailed on enterprise networks. These were desktop PCs whose general-purpose approach to computing resulted in bulging application programs that overran hard drives. The OS required to run them went on a RAM-page, requiring many megabytes of RAM and even more disk space.

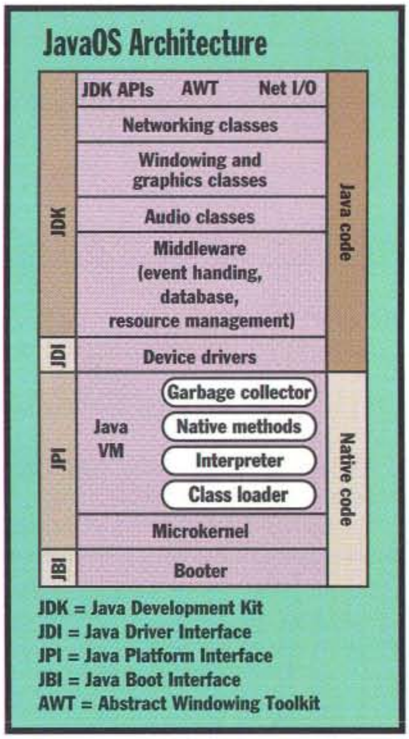
We are now seeing thin-client network computers (NCs) with a streamlined approach to computing. No longer fat, no longer stand-alone, no longer even bound to the desktop, such minimalist client machines require less RAM and can even forgo a hard drive.

How does the NC accomplish this? It's dynamically linked to powerful Internet or intranet servers. Only a small percentage of the system services reside on the NC at any given time; the remaining services are stored on the server and loaded on demand. Put another way, the servers store most of the nonessential system services, and the NC dips into them only when JavaOS says so. The result is a thin client with fat services available.

A Portable OS

JavaSoft designed JavaOS around the Java Virtual Machine (JVM). The JVM is the central component of the platform-independent run-time module. Additional system services (written in Java) are layered on top of the JVM, as well as various APIs derived from the Java Development Kit (JDK). These services and APIs have the traditional advantages of the Java language: dynamic class loading, run-time binding, platform independence, and security.

JavaOS is well suited for companies that want to standardize on a full-scale solution, because you can run Java applications—without porting—on every Java-enabled platform. With JavaOS powering both the boss's JavaStation and a field-service representative's remote paging device, information flows in a uniform and consistent format throughout the enterprise.


JavaOS Architecture
JDK APIs
AWT
Net I/O
Networking classes
Windowing and graphics classes
Audio classes
Middleware (event handing, database, resource management)
Device drivers
Java VM
Garbage collector
Native methods
Interpreter
Class loader
Microkernel
Booter
JDK
JDI
JPI
JBI
Java code
Native code
JDK = Java Development Kit
JDI = Java Driver Interface
JPI = Java Platform Interface
JBI = Java Boot Interface
AWT = Abstract Windowing Toolkit

Two-thirds of JavaOS is written in Java, while the microkernel is written in C.

Because it's portable, you can install JavaOS in any number of embedded devices. It operates with native kernels such as Mach and Solaris's Green Threads (a cooperative multitasking kernel that early JavaStations use), and with a variety of real-time OS (RTOS) kernels.

JavaSoft achieved JavaOS's portability by writing a great deal of it in the Java language. In fact, JavaOS 1.0 consists of 68 percent pure Java (a percentage that will grow in the future as the company adds more JDK support), 30 percent native C code, and 2 percent assembly language.

JavaOS has already been ported to numerous processors. These include the StrongARM, the PowerPC, the SPARC family of processors, the Hitachi SH-3, and the x86 product line from the 486 on up. The JavaOS license includes permission to modify system services, as long as you maintain compatibility with JDK standards.

JavaOS Architecture

JavaOS runs in a single address space, regardless of the platform it operates on. There is no supervisor mode, although it supports trusted code for device drivers. Trusted code lets drivers access classes not available to normal Java applications. A collection of classes called the Java Driver Interface (JDI) provides support for device drivers.

The heart of JavaOS remains the JVM. Java system services, drivers, applets, and applications execute on the JVM. A microkernel provides basic platform services, as shown in the figure "JavaOS Architecture." There is also a bootstrap loader (which is called the *booter*) that loads the core OS image. JavaSoft wrote the JavaOS microkernel mostly in C. It also uses small assembly language routines in areas where optimum performance is required.

The microkernel performs two main functions. First, it's tailored to a specific hardware platform so that it delivers optimum JVM performance. Second, the microkernel implements platform-specific functions such as multithreading, multiprocessing, memory management, interrupt handling, and native acceleration for critical system operations (e.g., video output).

Because it adheres to the thin-client model, the JavaOS native kernel weighs in at around 90 KB. The JVM and C support classes increase this footprint by 250

KB. Support for JDK 1.0 classes adds 1 MB of Java code, and JDK 1.1 support adds 1.5 MB to that. Thus, for 2 MB you get an embedded OS, while 8 MB (16 MB is recommended) gives you a network-capable OS with a browser.

JavaOS Boot System

The JavaOS boot system consists of 128 KB of code (this varies with the implementation), whose duty is to first load the core OS image and inform it of the device configuration of the platform. The output of the boot interface is a standard IEEE-1275 Open Firmware device tree, which defines the platform's devices and their interconnections.

For simple devices such as pagers, this information may consist of a precompiled data structure. For NCs with expansion slots, this boot configuration is determined using an OpenBoot PROM. JavaOS is bootable from ROM, flash memory, a hard drive, a floppy disk, or the network. Booting JavaOS from the network ensures that the most current core OS image is loaded to the client, but it increases network traffic.

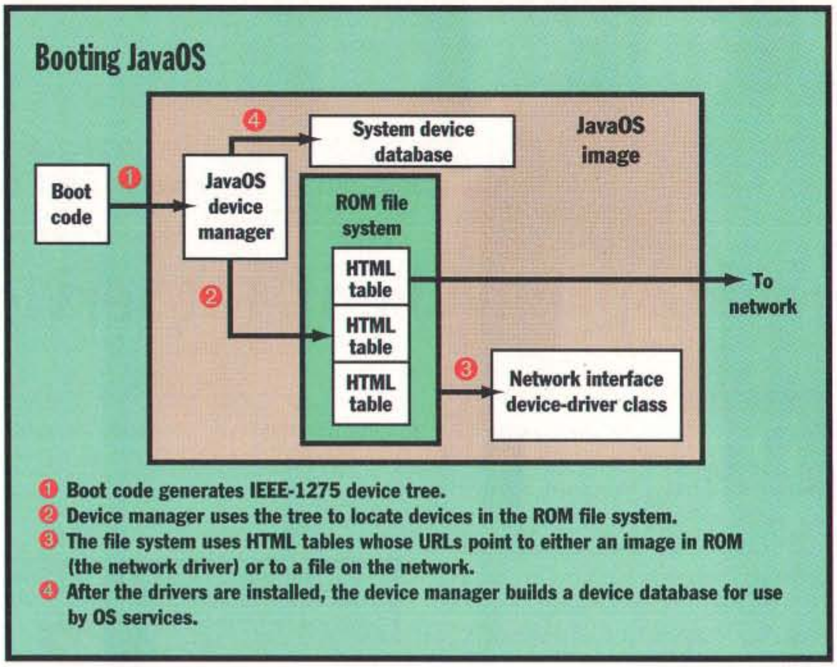
Device Drivers

JavaOS drivers access devices indirectly through platform classes that abstract interrupts, addressing, and memory management from the device hardware. Because drivers are shielded from direct contact with the hardware, OS integrity is maintained and processing errors are minimized.

Although independent of the system memory model, addressing scheme, and interrupt architecture, device drivers are nonetheless tied to a specific device/bus combination. In this sense, drivers still reflect the idiosyncrasies of particular devices and the bus architectures for which they are designed.

Drivers are associated with devices by way of a ROM file system linked into the OS binary. A special driver directory contains entries for device drivers appropriate for the platform.

Some of these drivers are linked in; in other words, their code is part of the basic OS image. The JavaOS network driver, for example, is always linked in, because it must be present at boot time to obtain other system services from the network. Other drivers exist outside the core OS image; the code for these drivers may be resident on the network.



① Boot code generates IEEE-1275 device tree.
② Device manager uses the tree to locate devices in the ROM file system.
③ The file system uses HTML tables whose URLs point to either an image in ROM (the network driver) or to a file on the network.
④ After the drivers are installed, the device manager builds a device database for use by OS services.

JavaOS uses an Open Firmware device tree supplied by the boot code to locate the platform's device drivers.

Because JavaOS is network-centric, you use HTML files to identify drivers in the ROM file system. One entry in a driver HTML file is a URL defining the location of the driver code. This URL can point to a location in the OS binary (as in the case of the linked-in network driver), or it can point to a location on the network.

A special system class known as the device manager reads device information from the device tree and builds the system device database. This database includes entries for each device on the platform. It keeps track of which class files implement interfaces to the different devices. The device manager uses the ROM file system to associate interfaces and devices with device drivers, as shown in the figure "Booting JavaOS."

Because device drivers in JavaOS are identified using HTML files, it is possible to use a Web browser to view the system-device topology even on another JavaOS client (permissions allowing). This is useful for remote diagnosis and debugging.

It is also possible for the system device database to update itself dynamically as devices are added or removed from the system. This is true whether access occurs by way of hot-pluggable cards or by network installation.

One Hot Brew

JavaOS provides fat-client functionality with a thin-client footprint. Eventually, JavaOS can be counted on to let large enterprises standardize on a scalable Java delivery solution for pagers, digital phones, NCs, and workstations.

JavaOS provides an opportunity for kernel vendors to expand into the larger market for Java-application platforms. By embedding its kernel beneath JavaOS, a kernel vendor maintains the technological advantages of its product while gaining competitive access to a large installed base of Java applications.

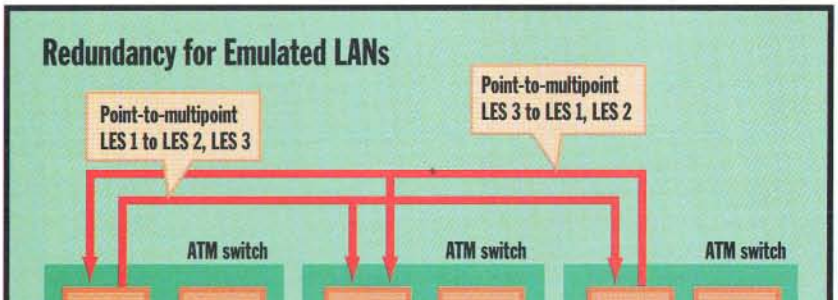
Large-scale deployment of JavaOS may lead to increased network traffic and greater vulnerability to server downtime. But future versions are expected to implement object caching, possibly based on a least-recently-used algorithm. Object caching will substantially lessen network traffic and decrease vulnerability to server downtime. Caching may require the presence of flash memory or a small hard drive on the client platform. **B**

Charles Mirho is an author/programmer working in Silicon Valley. You can reach him at **mirho@pacbell.net.** *Tom Clements is a technical writer for Sun Microsystems' JavaSoft division. You can reach him at* **tom.clements@eng.sun.com.**

Making a robust ATM network requires more than extra cables. Proper switch and router configuration is crucial. *By Jeffrey Fritz*

Bulletproofing ATM, Part 2

Last month we discussed various methods of providing redundancy for asynchronous transfer mode (ATM) backbone networks. We explained how setting up ATM switches in a full-mesh configuration and connecting end-stations in a dual-homed fashion provides fault tolerance. We also said that creating redundant LAN Emulation Server/Broadcast and Unknown Server (LES/BUS) pairs using multiple ATM devices was a good method of ensuring the availability of LAN Emulation (LANE) services. This month, we'll go into the details of creating redundant LANE services, and we'll learn how redundancy for an ATM network can sometimes work against you.


Redundancy for Emulated LANs
Point-to-multipoint LES 1 to LES 2, LES 3
Point-to-multipoint LES 3 to LES 1, LES 2
Point-to-multipoint LES 2 to LES 1, LES 3
ATM switch
ATM switch
ATM switch
LES 1
BUS 1
LES 2
BUS 2
LES 3
BUS 3
LEC A
LEC B
LEC C
LES = LAN Emulation Server
BUS = Broadcast and Unknown Server
LEC = LAN Emulation Client
Note: Similar point-to-multipoint connections exist for BUS 1, 2, and 3. They have been omitted for clarity.

Redundant LES/BUS pairs provide load sharing and eliminate single-point failures.

Redundant LES/BUS Pairs

The ATM Forum's upcoming LANE Version 2.0 will provide redundancy for LANE services. The February 1995 LANE 1.0 specification doesn't provide details for LANE redundancy, but from an implementation perspective it doesn't prohibit redundancy. Under LANE 1.0, vendors have implemented methods of providing LANE redundancy that may or may not interoperate—even though they provide the same form of redundancy.

One of the most common forms of LANE redundancy allows each LES to be made aware of all the other LANE servers on the same emulated LAN (e-LAN). When this occurs, the LESes are said to be operating as "cooperating pairs." Of course, the ATM devices running LANE services must be able to support redundant LES/BUS pairs.

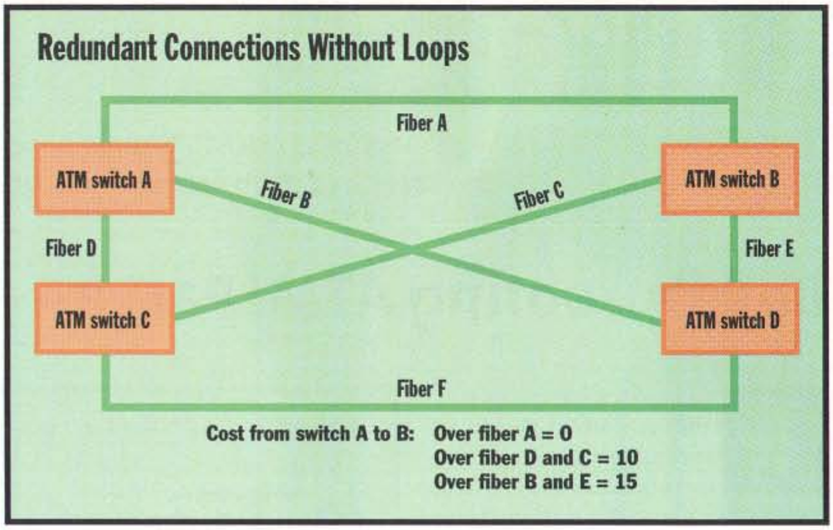
The figure "Redundancy for Emulated LANs" illustrates how redundant LES/BUS pairs can be configured. Notice that LAN emulation client (LEC) A is served by LES/BUS pair 1, LEC B is served by LES/BUS pair 2, and LEC C is served by LES/BUS pair 3. In reality, multiple LECs can and usually are supported by a single LES/BUS pair. However, for simplicity we have shown only one LEC per LES/BUS pair.

Cooperating LES devices use point-to-multipoint connections from each LES to each of the other LES pairs associated with that particular e-LAN. As can be seen from the figure, there is a point-to-multipoint connection from LES 1 to LES 2 and LES 3. Similarly, LES 2 has point-to-multipoint connections to LES 1 and LES 3. And LES 3 has a point-to-multipoint connection to LES 1 and LES 2. Using the point-to-multipoint connections, each LES becomes aware of the other LES servers on its e-LAN and can exchange information with them. Since the same configuration information exists in all the cooperating LANE servers, should one of the LES/BUS devices fail, another pair simply takes over for the failed device. The same redundancy occurs if a cable feeding a LES/BUS device is cut.

For clarity, the figure shows only the connections to the LANE servers. However, the same kind of redundancy is usually done for the BUS as well. Each BUS has point-to-multipoint connections to all the other BUS pairs in the e-LAN. Should one BUS fail, another can take its place.

Fault-Recovery Times

In connectionless networks like Ethernet, every packet is routed individually. This makes fault recovery easy and rapid. However, ATM relies on calls placed through virtual channel connections (VCCs) to move data through the network. When a disruption occurs, the switches in an ATM network must reroute the existing calls. This takes time. Also,



Loops can be eliminated by specifying preferred routes among the switches.

the ATM network has to deal with more than one call type. Some calls are set up over a data-direct VCC. The data-direct VCC carries unicast user data. That is, the VCC acts as a typical data circuit, much like a telephone connection. Other calls are set up over control-direct or configure-direct VCCs. These VCCs are primarily used for LANE services and broadcasts. They are analogous to the telephone system's control infrastructure that helps route calls from the calling to the called party. These VCCs typically support connections to the LES and BUS.

When a network outage interrupts only the data-direct VCCs, recovery times tend to be rapid. This is because the control- and configure-direct VCCs are still alive, so the LANE services themselves are unaffected by the outage. All that is required is reconnecting the data-direct calls, a fairly straightforward process.

However, when control- or configure-direct VCCs are disrupted, the LANE services themselves are interrupted. The LANE clients that lose LANE services make a graceful (we hope) exit from the ATM network. Before the data-direct calls can be restored, the LANE clients must reconnect with the appropriate LES/BUS and reregister with the LANE services. This process takes considerably longer than simply reconnecting data-direct calls.

The good news is that in either case the recovery will be rapid, depending on which links are disrupted and how many switches are involved. In a typical backbone network, calls can be restored in under 30 seconds. For network outages, that's a very respectable amount of time.

Bridge Loops

Loops occur when there are multiple paths from a source to a destination in a bridged environment. Bridge loops are nasty: They cause traffic storms that can easily bring an entire enterprise network to its knees. Keep in mind that redundant links, if not properly configured, can become bridge loops.

In LANE version 1.0, everything within an e-LAN is bridged. This makes it easy to accidentally create loops since, in providing redundancy, we are indeed creating multiple parallel paths. However, there are steps that can be taken to eliminate bridge loops.

Some ATM switches support the IEEE 802.1d Spanning Tree protocol. Spanning Tree was developed specifically to prevent bridge loops. It does this by assigning path costs to parallel links. Simply put, the Spanning Tree algorithm automatically turns off the switch or bridge ports on parallel links with the highest path cost. This disables the parallel paths and prevents looping. If the primary link fails, the algorithm turns back on the port connecting the redundant path.

Unfortunately, not every ATM switch supports Spanning Tree. However, even in these switches, looping can be avoided. Suppose switch A in the figure "Redundant Connections Without Loops" is told that the cost to switch B over fiber A is zero. However, the cost to B through alternative paths, such as fibers D and C or B and E, is 10 or 15, respectively. Since the redundant paths are associated with higher costs, they will not be used unless the primary path does not exist. Therefore looping is less likely to occur. The cost values are configured on a port-connection basis by the network administrator. No matter what method you choose, the goal is to have redundant paths stay dormant until the main paths fail.

Proactive Monitoring

It is easy to become overly reassured by networks designed with a high degree of redundancy. However, this false sense of assurance can be dangerous. More than a few network managers have been surprised when their already wrapped FDDI rings suffered an additional failure. Sadly, these managers were blissfully unaware of the original wrap until the network was neatly sliced into two by the second failure.

Clearly, quick action must be taken to correct the initial situation, particularly if the network's redundancy masks a serious problem. The staff should proactively monitor the network's health to ensure that it is fully functional. This means regular and careful checks on fiber connections, switches, routers, and ATM end-stations. Suffice it to say that monitoring the network's state with management tools such as SNMP or Integrated Local Management Interface is essential.

Surviving Loss

ATM networks can be built with the ability to survive the loss of multiple cables and multiple switches. Combining redundant, cooperating LES/BUS services with full-meshed and dual-homed cabling provides a high degree of survivability to any ATM network. This means that even with its connection-oriented, point-to-point and point-to-multipoint configuration, an ATM backbone can still be made bulletproof. Should an ATM switch go down, or a cable feeding it fail, the network will survive. **B**

Jeffrey Fritz (**jfritz@wvu.edu**) *is responsible for advanced network technology at West Virginia University. He is the author of* Remote LAN Access: A Guide for Networkers and the Rest of Us *(Manning Publications/Prentice-Hall PTR) and* Sensible ISDN Data Applications *(West Virginia University Press).*

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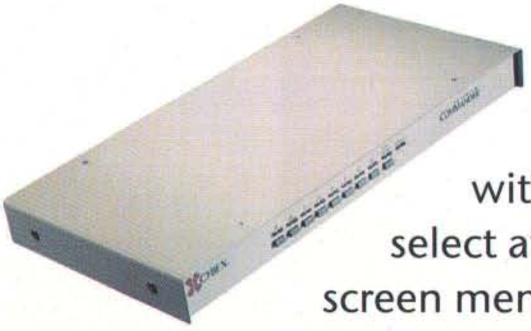

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Good-Bye, GUI HELLO, NUI

Network-centric user interfaces are coming to PCs as well as to network computers.

By Tom R. Halfhill

If your computer has a screen and is on a network, you need to read this article. Why? More than a dozen network-centric user interfaces are coming to PCs and network computers (NCs) this year, from the likes of Apple, IBM, Lotus, Microsoft, Netscape, Oracle, Sun, and others. It's the biggest revolution in GUIs since 1984. And it's happening so fast that even the buzzwords can't keep up. Nobody can agree on what to call them: NC GUIs (for network-centric graphical user interfaces), WUIs (for Web user interfaces), virtual desktops, active desktops, or Webtops?

To settle the confusion, BYTE suggests NUI (pronounced "new-ee"), short for network user interface. NUIs offer a consistent, browser-like interface for navigating local and remote file systems. They can display Java applets and other dynamic Web content on their desktops without a Web browser. They automatically update dynamic content using "push" and "pull" Webcasting technologies. And they will blur the increasingly irrelevant distinctions between native/cross-platform and local/remote applications.

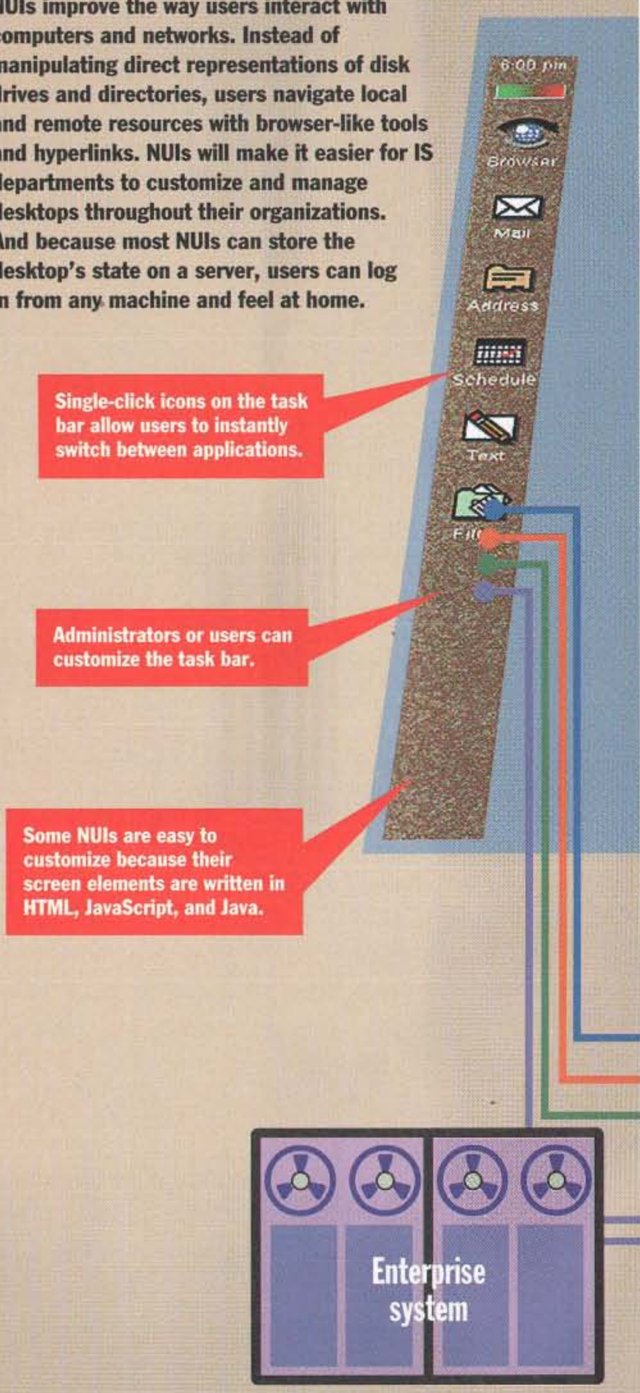
Most NUIs will offer at least the option of storing or mirroring a client's local state on a server—whether the client is an inherently stateless NC or a regular PC. By shifting complexity away from clients and toward professionally managed servers, organizations can slash their administration costs. This also gives users the freedom to remotely access their applications and personalized workspaces from any networked computer in the world.

While most developers are designing their NUIs for low-cost NCs, the wave is sweeping PCs along, too. Microsoft is adding browser-like file navigation to Memphis (aka Windows 97) and Windows NT and is embedding Internet Explorer 4.0

Assembling the Network User Interface

This composite screen shows some features from a dozen different NUIs.

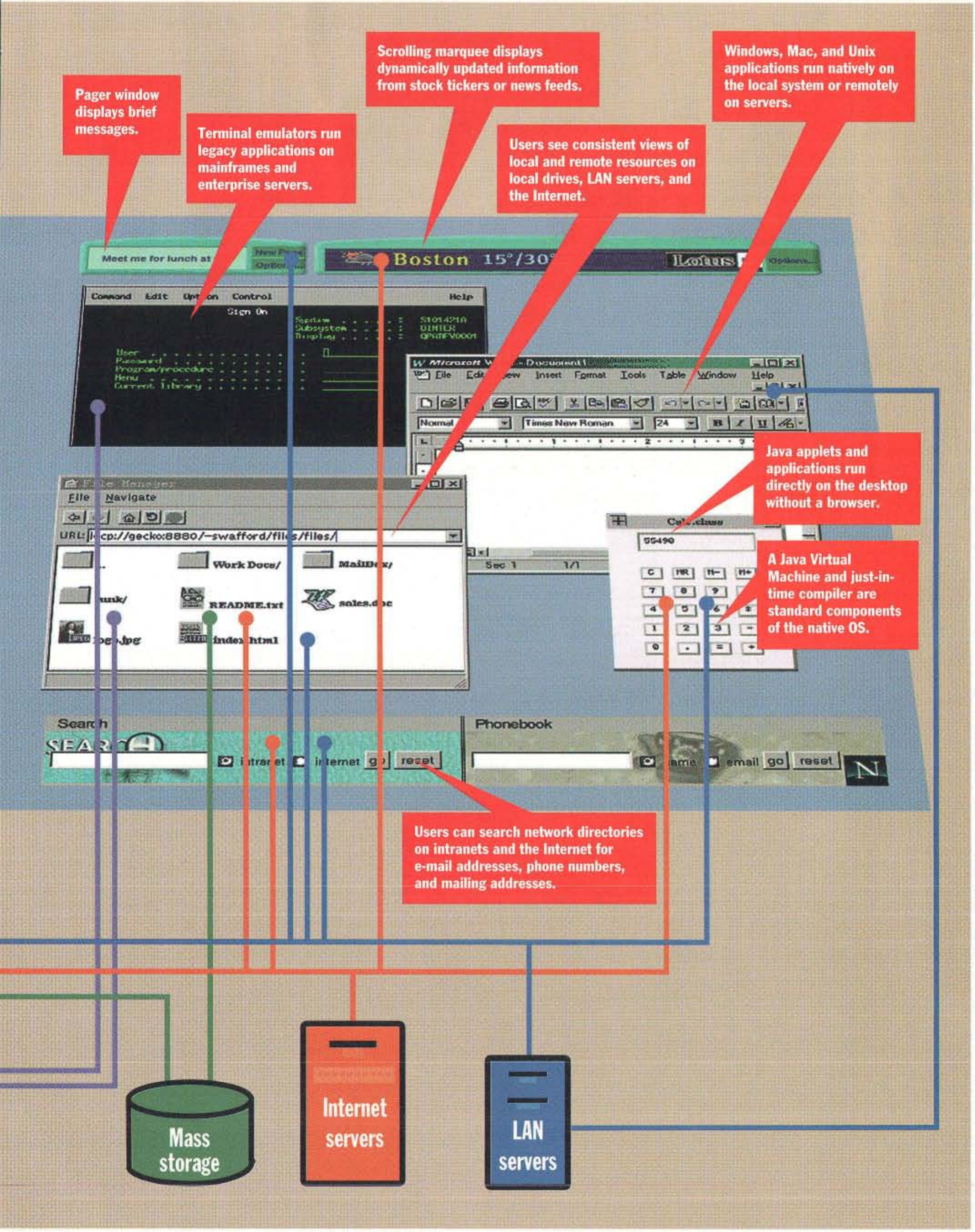
NUIs improve the way users interact with computers and networks. Instead of manipulating direct representations of disk drives and directories, users navigate local and remote resources with browser-like tools and hyperlinks. NUIs will make it easier for IS departments to customize and manage desktops throughout their organizations. And because most NUIs can store the desktop's state on a server, users can log in from any machine and feel at home.



Single-click icons on the task bar allow users to instantly switch between applications.

Administrators or users can customize the task bar.

Some NUIs are easy to customize because their screen elements are written in HTML, JavaScript, and Java.



Pager window displays brief messages.

Scrolling marquee displays dynamically updated information from stock tickers or news feeds.

Windows, Mac, and Unix applications run natively on the local system or remotely on servers.

Terminal emulators run legacy applications on mainframes and enterprise servers.

Users see consistent views of local and remote resources on local drives, LAN servers, and the Internet.

Java applets and applications run directly on the desktop without a browser.

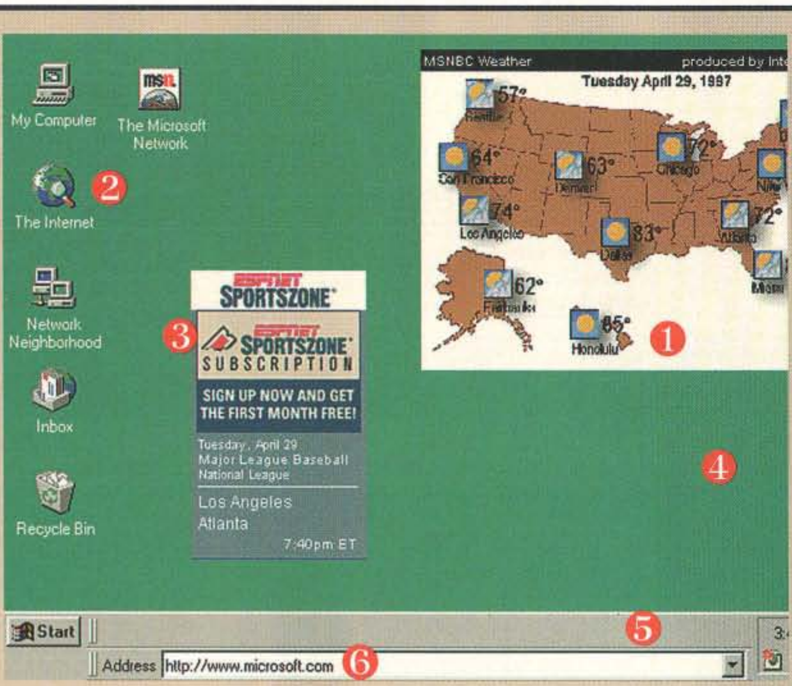
A Java Virtual Machine and just-in-time compiler are standard components of the native OS.

Users can search network directories on intranets and the Internet for e-mail addresses, phone numbers, and mailing addresses.

deeply into Windows. IBM has already added some network-centric features to OS/2 Warp 4, such as a Java Virtual Machine (VM). IBM is also developing a NUI, code-named "Bluebird," that will offer a compromise between thin-client NCs and fat-client PCs. Apple is weaving quick Internet access into Mac OS 8 (aka Tempo) and Rhapsody, along with personal Web publishing and other features. Netscape's Constellation is a NUI that overlays a PC's existing GUI.

For NCs, there are even more NUIs on the way. Oracle's NC Desktop runs on NCs that comply with Oracle's NC reference platforms. IBM has a NUI for its PowerPC-based Network Station. Sun Microsystems' HotJava Views runs on Sun's SPARC-based JavaStations or any machine with a Java VM because it's written in Java. The same goes for TriTeal's SoftNC, Lotus Development's Kona Desktop, The Santa Cruz Operation's (SCO's) Tarantella WebTop, and Ulysses Telemedia's Virtual Computer OS (VCOS). Netscape wrote Constellation in HTML, Java, and JavaScript, so it, too, runs on multiple platforms.

The primary target for all these revamped GUIs and NUIs is corporate users who enjoy fast, direct access to LANs and the Internet. Some mobile users, telecommuters, and consumers with slower dial-up connections will also find them useful. Beyond the scope of this article, however, are NUIs for consumer-oriented network devices, such as WebTV set-top boxes and the Sega Saturn.



Microsoft's Active Desktop embeds Internet Explorer 4.0 into the OS to add network-centric features to Windows.

1. Web pages can appear on the desktop without a browser.

2. Users can still launch a stand-alone Web browser, but it's no longer necessary.

3. Web content on the desktop can include dynamically updated information from "push" services, Java applets, and ActiveX controls.

4. Instead of wallpaper, the entire desktop could be a Web page (not shown).

5. Web servers can display pages or scrolling marquees on the task bar (not shown).

6. Users can browse remote or local resources by entering URLs or directory names here.

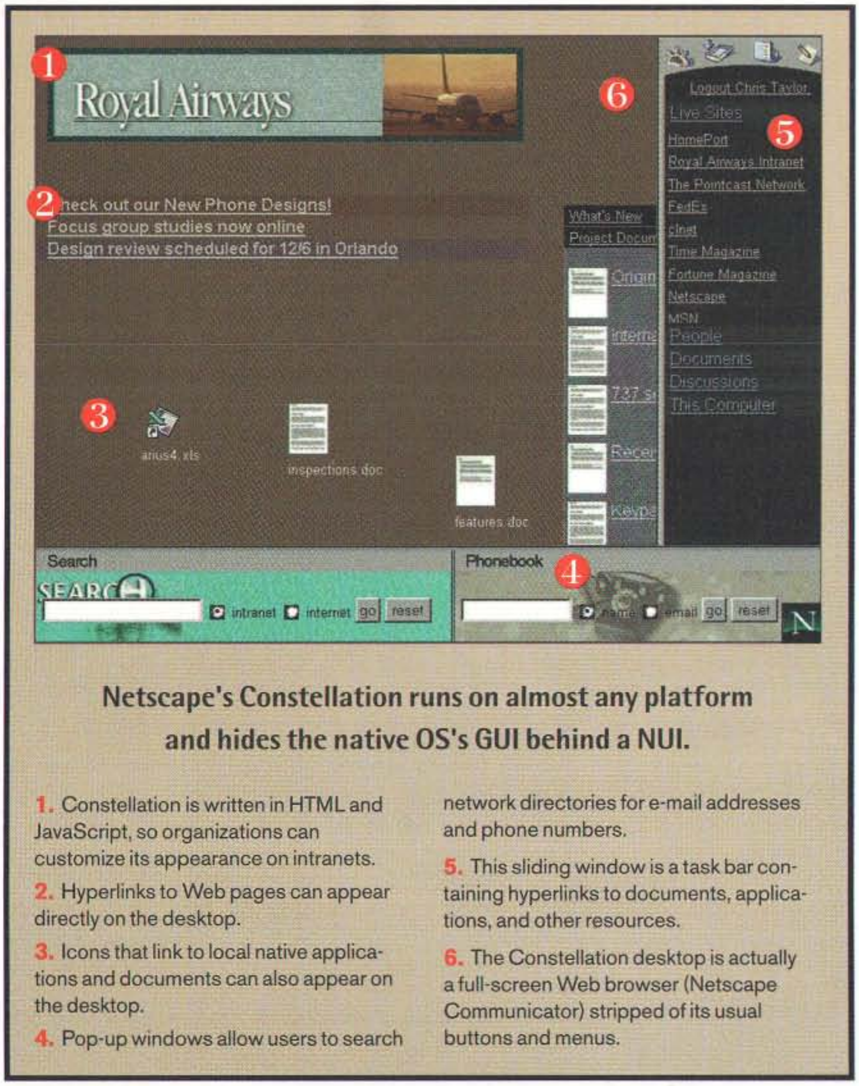
Comparing NUIs

	Constellation	HotJava Views	Kona Desktop	Memphis/ Active Desktop	Mac OS 8
Vendor	Netscape	Sun/JavaSoft	Lotus	Microsoft	Apple
Hardware platform	Cross-platform	Cross-platform	Cross-platform	x86-based PCs	Macintosh
NUI code base	HTML, JavaScript	Java	Java	Native code	Native code
Applications software	Native, Java	Java	Native, Java	Native, Java	Native, Java
Can run legacy apps**	✓	✓	✓	✓	✓
Includes Java VM	✓	✓	✓	✓	✓
Introduces a new UI	✓	✓	✓	Partly	Partly
Includes Web browser	✓	✓	✓	✓	✓
Runs Java on desktop	✓	✓	✓	✓	
Stores state on server	✓	✓	✓	Optional	
Release date	June 1997?	March 1997	Summer 1997	Late 1997/early 1998	Summer 1997

* NC Desktop will run on Oracle-standard network computers with ARM, StrongARM, and x86 microprocessors.

** So-called legacy applications include IBM 3270 and 5250; DEC VAX/VMS; Unix character-based programs; the X Window System; and Microsoft Windows.

✓ = yes.



Netscape's Constellation runs on almost any platform and hides the native OS's GUI behind a NUI.

1. Constellation is written in HTML and JavaScript, so organizations can customize its appearance on intranets.
2. Hyperlinks to Web pages can appear directly on the desktop.
3. Icons that link to local native applications and documents can also appear on the desktop.
4. Pop-up windows allow users to search network directories for e-mail addresses and phone numbers.
5. This sliding window is a task bar containing hyperlinks to documents, applications, and other resources.
6. The Constellation desktop is actually a full-screen Web browser (Netscape Communicator) stripped of its usual buttons and menus.

Bury the Browser

The appearance of two or three NUIs might be chalked up to coincidence, but an avalanche of NUIs signifies a major trend. The reason, of course, is networking. LANs have been around for more than a decade, but only in the past few years have data networks become nearly ubiquitous. In large- and medium-size corporations, 94 percent of desktop PCs are tethered to networks, according to Greg Cline, director of network integration and management research at the Business Research Group. Even on home computers and laptops, modems are virtually standard equipment, so practically everyone has at least intermittent access to a network.

It's easy to see why GUIs are falling behind. Their original designers were trying to replace command-line interfaces with graphical views of the file system and OS. Their goal was to make it easier to manage a few megabytes of local resources. But today's users confront a virtual file system that's global in scope and adds up to terabytes.

Rampant networking would be reason enough to add network-centric features to desk-centric GUIs. But there are six other reasons why it's time for something NUI:

Executable content. Today's software is no longer just native and local. Instead it might arrive on the spur of the moment from a server machine located thousands of miles away. What's more, the "application" might be a live stock ticker or a

NC Desktop	**Network Station**	**OS/2 Warp 4**	**Bluebird**	**Rhapsody**	**SoftNC**	**Tarantella WebTop**	**VCOS**
Oracle/NCI	IBM	IBM	IBM	Apple	TriTeal	SCO	Ulysses
NCs*	PowerPC	x86-based PCs	x86-based PCs	Power Macs	Cross-platform	Cross-platform	Cross-platform
Native code	Native code	Native code	Native code	Native code	Java	HTML, JavaScript	Java
Native, Java	Native, Java	Native, Java	Native, Java	Native, Java	Native, Java	Java	Java
✓	✓	✓	✓	✓	✓	✓	✓
✓	Optional	✓	✓	✓			
✓	Partly		Optional	✓			✓
✓	✓	✓	✓	✓			
✓	✓	✓	✓	✓	✓		✓
✓	✓		✓	Optional	✓	✓	✓
Sept. 1997	Sept. 1996	Sept. 1996	Summer 1997	Early 1998	Fall 1997	Fall 1997	June 1997

news feed that your system automatically updates by polling a Web server.

Legacy code. Programmers can't rewrite legacy applications overnight. So, all NUIs provide gateways to legacy programs and databases—often as Java applets that emulate legacy terminals.

New users. Many new users concentrate on a few basic tasks and don't need a full-featured GUI any more than the average snapshooter needs a Hasselblad.

Rethinking the GUI. Software engineers are reconsidering old assumptions and applying new knowledge. Some NUIs discard features that cause trouble for casual users, such as double-clicking, overlapping windows, hierarchical menus, and hieroglyphic button bars.

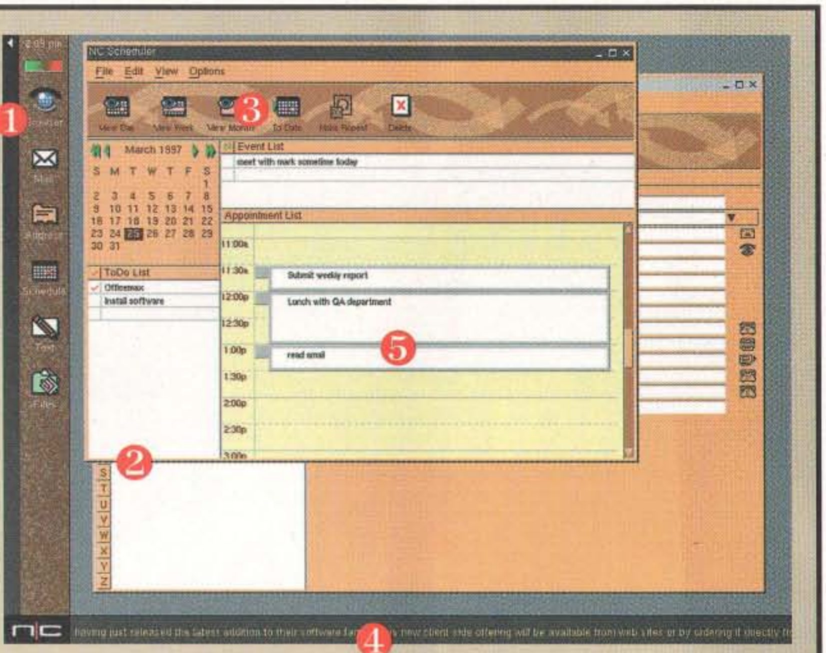
Remote access. NUIs will make it easier for mobile workers to exchange e-mail, tap into corporate networks, and duplicate their desktop experience from remote locations.

Changing work forces. NUIs can make it easier to share computers among workers by storing local state on a server, so users can access their personalized workspaces no matter where they log on.

All NUIs have one thing in common: They try to make network resources seem as familiar as local resources. Of course, they can't hide the physical boundaries imposed by bandwidth limitations. A remote Web server will always take longer to access than an internal hard drive. But what a NUI can do is make those boundaries seem less abrupt.

One way to do this is to present a universal, graphical view of all resources. Another is to integrate networking into common desktop operations rather than force users to launch special programs to perform tasks that are becoming routine. Over time, NUIs will absorb the functions of the separate client programs that are now required to use networks: Web browsers, newsreaders, FTP clients, e-mail clients, HTML editors, and more.

Web browsers are the trophy target for this kind of integration because browsers have become the prime application in network-centric computing. Ironically, nobody is doing more to make browsers obsolete than the two leading browser vendors: Microsoft and Netscape. With Memphis, Microsoft threatens to make Navigator irrelevant by embedding Internet Explorer 4.0 into Windows. With Constellation, Netscape threatens to make Windows irrelevant by expanding its browser into a full-screen desktop that hides Windows behind a curtain.



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Install software

11:30a Submit weekly report
12:00p Lunch with QA department
1:00p read email

Oracle's NC Desktop runs natively on NCs with x86, ARM, and StrongARM processors. The x86 version also runs on PCs.

1. Switch applications by single-clicking on the task bar.

2. The scheduler is running in the foreground, while the address program runs in another window.

3. A button bar controls the scheduler.

4. An optional scrolling marquee displays information automatically downloaded from servers.

5. The OS renders all documents as HTML.

Microsoft appears to be going further than Apple, IBM, or any Unix vendor in remodeling its GUI. Memphis and Windows NT will implement a new Microsoft strategy called "Web PC"—the grand unification of the Web and the desktop.

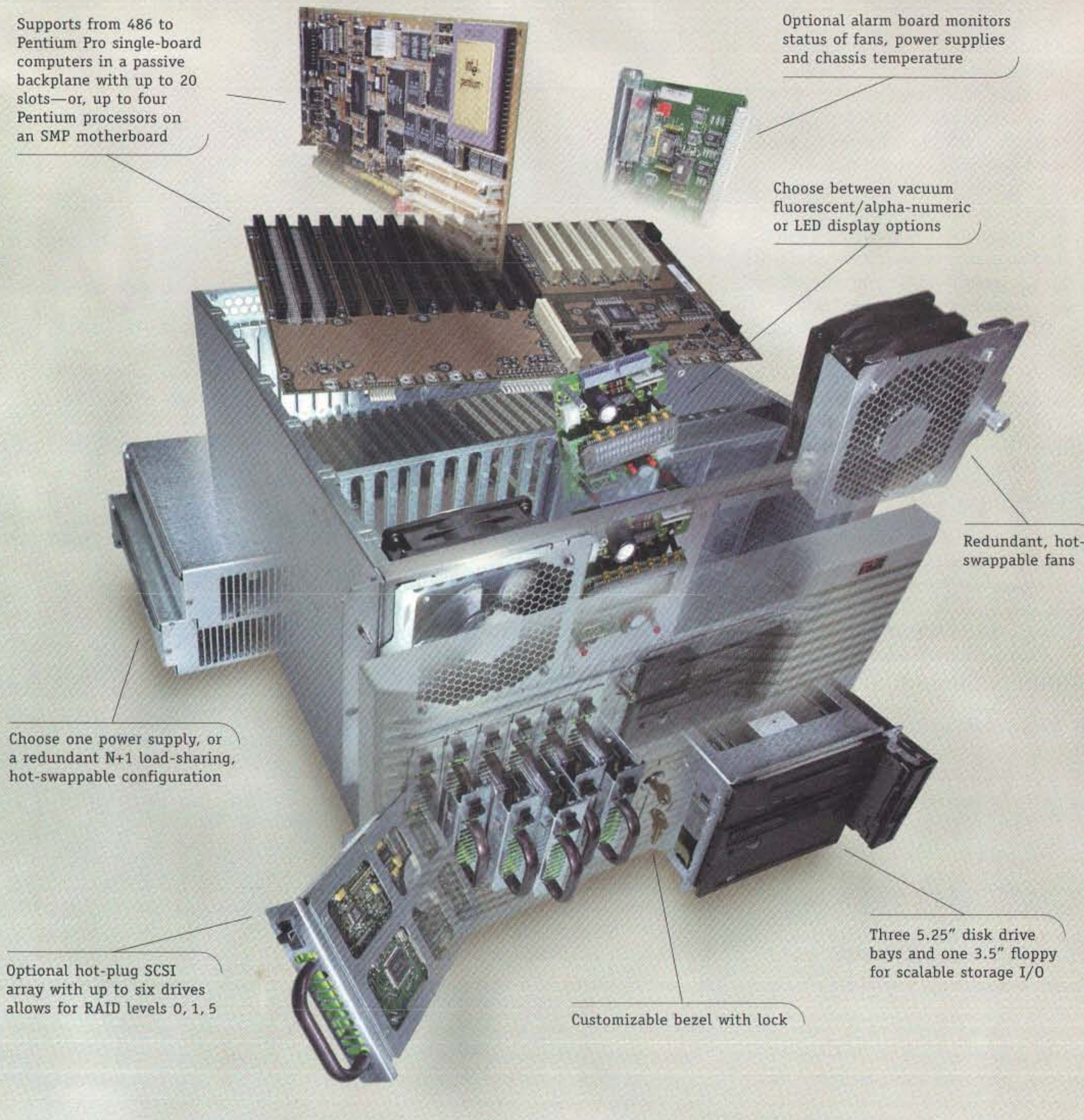
Soon Windows users will be able to navigate local disks and LAN servers by choosing an optional Web View that works like a Web browser, complete with single-click Forward and Back buttons and bookmarks. Or they'll be able to navigate Web sites with the familiar Windows Explorer instead of a browser. Folders on local disks and LANs can have "home pages" constructed with HTML, Java, JavaScript, VBScript, and ActiveX controls. Web content can appear in windows directly on the desktop or on the task bar, without a browser. In fact, the entire Windows desktop can be a Web page, and it can periodically update dynamic content by polling Web servers as a background task.

Windows users will still be able to launch Internet Explorer 4.0 as a standalone application. But they will have less reason to do so (or to launch anybody else's browser) because it's so tightly integrated. In effect, Internet Explorer and the Windows Explorer will be virtually the same thing.

What makes this possible is an ActiveX control in Internet Explorer that can display HTML, run Java applets, and work with other ActiveX controls. In version 4.0, that control now hooks directly into the OS. Microsoft has added another ActiveX control that allows the Windows Explorer to navigate local folders with a browser-like interface.

Microsoft's Active Desktop turns the entire computer screen into a virtual Web browser. The idea is to replace static wallpaper and mindless screen savers with useful content. Your desktop could be CNN's home page, or a Web page you design yourself, or a page supplied by your company. You can even display multiple Web pages in separate floating windows. If any pages contain dynamic content, Windows periodically updates them according to a schedule that you specify.

continued



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Users can also dock a Web page as a task bar. Like the existing task bar in Windows 95 and NT, it can remain always visible or hidden at the edge of the screen. It will be resizable to any size or shape, and Microsoft will provide a Software Development Kit that helps Web designers create special pages to fit the bar.

The result of all these new features is that upcoming versions of Windows will have much tighter Web integration than any other OS (see the text box "What's NUI with OS/2 and the Mac" at right). It's more like "Doorways" than "Windows" because you're interacting with the outside world, not just looking at a screen. Yet Microsoft is retaining everything in the existing Windows GUI, so users don't have to abandon the familiar interface.

Netscape's Star

Where does all this leave Netscape, the leading browser vendor? Although Windows users can install anyone's Web browser, nothing will be as tightly integrated as Internet Explorer 4.0. Netscape's response is to arrive at a remarkably similar destination by a completely different route: Instead of hiding the browser behind the GUI, Netscape is hiding the GUI behind the browser.

Constellation is a NUI built upon what Netscape calls a "chromeless" browser. The desktop is a full-screen browser window, stripped clean of the usual menus, buttons, icons, and other widgets (the "chrome"). In effect, the browser *is* the desktop. Like the Active Desktop in Windows, Constellation is a container for displaying rich Web content without all the fuss and bother of a stand-alone browser program.

Technically, as Netscape hastens to point out, Constellation does not replace Windows. It's not an OS, and it doesn't usurp machine-specific functions. Users still need Windows for fundamental OS services and to perform common system operations. For example, users must switch back to Windows to change settings in a Windows control panel.

Constellation's desktop is called the Homeport. It's written in HTML, Java, and JavaScript, so it's cross-platform—Netscape says that it will run on 18 different OSes. (Through Navio, Netscape's subsidiary for consumer software, it will also appear on home video-game machines and Internet-enabled TVs.) Although Microsoft says the Active Desktop will also be cross-platform, it's so dependent on Windows APIs and ActiveX that sacrifices are inevitable on non-Windows systems. "Netscape assumes there will be greater [platform] fragmentation in the future, and Constellation is designed to take advantage of that fragmentation," says Mike McCue, Netscape's director of advanced technology.

What's NUI with OS/2 and the Mac

Apple and IBM aren't going as far as Microsoft is to turn their GUIs into NUIs, but both have been weaving network-centric features into their OSes for years.

OS/2 Warp 4, released last September, comes with two Web browsers (Navigator and Web Explorer) and was the first OS to integrate a Java VM. Java applets and applications can run in the OS/2 Workplace Shell without a browser, just like native applications.

The Workplace Shell also extends the metaphor of files and folders to networked resources. Users can easily create folders and icons that represent nearby servers on LANs or distant servers on the Internet and then manipulate those resources as if they were local drives and directories.

In Mac OS 8, scheduled for release this summer, Apple is providing desktop icons to launch the user's preferred Web and e-mail clients (which will be bundled), plus a menu item that automatically launches the appropriate client software when a user pastes any URL into a pop-up dialog box. Apple also plans to bundle a "push" client, such as PointCast, with Mac OS 8. But not until a later release will Mac users get true desktop integration of dynamic Web content, clickable live links to URLs, and Apple's long-delayed V-Twin search engine, which spans local and remote resources.

Both Apple and IBM have bigger plans for the future. Apple's Rhapsody–the next-generation OS based on NextStep–will include the OpenStep Virtual Desktop. It's a location-independent NUI that preserves all local state on a server, so users can access their personalized desktops from any networked client. The wiring behind it is NetInfo–client/server software that provides remote administration and directory services. NetInfo automatically configures new clients and determines which domains they can access.

IBM is developing an evolutionary NUI that offers a middle-ground alternative between thin-client NCs and fat-client PCs. Code-named "Bluebird," it replaces the Workplace Shell in Warp with a lightweight, network-centric shell that rides atop the OS/2 kernel. It has a default desktop that runs Java applets without a browser, but administrators can substitute a Web browser, a "green-screen" terminal emulator, or any custom application as the default environment.

Bluebird is a compromise between NCs and PCs because it runs on standard x86-based systems but also stores local state on a server and uses the local hard drive as a software cache. Thus, it offers some advantages of an NC while maintaining compatibility with existing hardware.

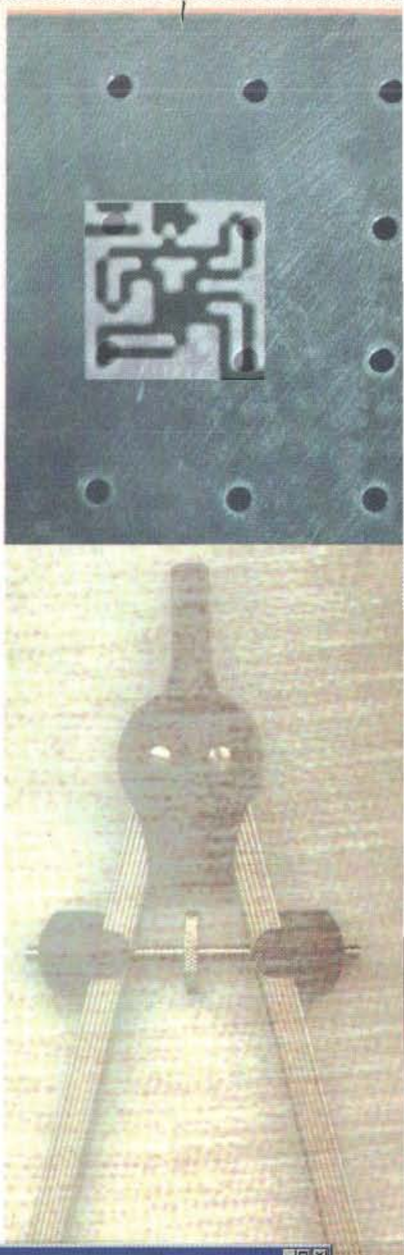
IBM says it designed Bluebird because some large corporate customers asked for a low-cost solution that will ease the transition to NCs. "Customers are asking how to get to the new Java model while still leveraging their existing applications on multiple platforms," explains John Albee, IBM OS/2 Warp program manager.

Albee says Bluebird will ship to corporate customers this summer. In concept, it's similar to Microsoft's NetPC initiative and Zero Administration for Windows (ZAW)–a slimmer-client alternative to NCs that builds on today's PC standards (see "PCs Strike Back," May BYTE).

Location independence is another keystone of Constellation. By optionally storing the Homeport's state on a Netscape SuiteSpot server, Constellation allows users to log on from anywhere in the world and retrieve their personalized Homeport. For example, you could start a task on your PC at the office and finish it later on an NC in an airport lounge or hotel.

Like the Active Desktop, the Homeport is a lively place where Web pages can appear in floating windows and on sliding panels. Microsoft allows you to dock Web pages on task bars; Netscape has Infoblocks (pagelets written in HTML and JavaScript) that dock in a similar fashion along the edges of the screen. Dynamic content changes automatically, thanks to Marimba's Castanet Tuner and PointCast, a pair of Web "push" clients built into Constellation. (Netscape prefers the more accurate term *smart pull*.)

Although there's room in the world for both the Active Desktop and Constellation, Netscape will fare better if the platform fragmentation it anticipates happens soon enough to matter. For now, Windows rules the desktop. Sheer inertia could keep Windows users from adopting Constellation, especially since both NUIs bring a similar experience to the screen. *continued*



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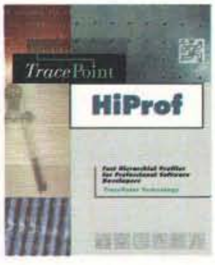

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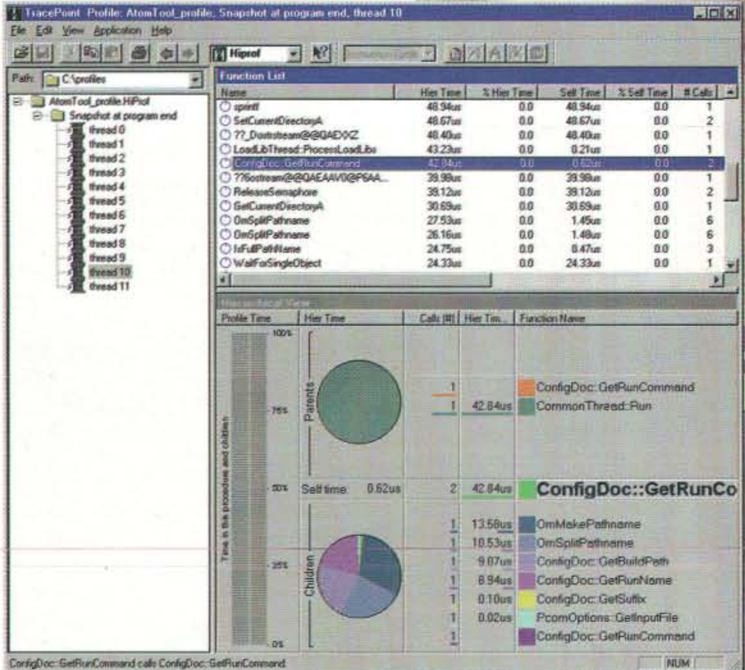

Name	Hier Time	% Hier Time	Self Time	% Self Time	# Calls
sprintf	48.94us	0.0	48.94us	0.0	1
SetCurrentDirectoryA	48.67us	0.0	48.67us	0.0	2
??_D ostream@@QAEXXZ	48.40us	0.0	48.40us	0.0	1
LoadLibThread::ProcessLoadLibs	43.23us	0.0	0.21us	0.0	1
ConfigDoc::GetRunCommand	42.84us	0.0	0.62us	0.0	2
??6ostream@@QAEAAV0@PBAA...	39.98us	0.0	39.98us	0.0	1
ReleaseSemaphore	39.12us	0.0	39.12us	0.0	2
GetCurrentDirectoryA	30.69us	0.0	30.69us	0.0	1
OmSplitPathname	27.53us	0.0	1.45us	0.0	6
OmSplitPathname	26.16us	0.0	1.48us	0.0	6
IsFullPathName	24.75us	0.0	0.47us	0.0	3
WaitForSingleObject	24.33us	0.0	24.33us	0.0	1

Hier Time	Calls (#)	Hier Tim...	Function Name
	1		ConfigDoc::GetRunCommand
	1	42.84us	CommonThread::Run
Self time: 0.62us	2	42.84us	ConfigDoc::GetRunCo
	1	13.56us	OmMakePathname
	1	10.53us	OmSplitPathname
	1	9.07us	ConfigDoc::GetBuildPath
	1	8.94us	ConfigDoc::GetRunName
	1	0.10us	ConfigDoc::GetSuffix
	1	0.02us	PcomOptions::GetInputFile
	1		ConfigDoc::GetRunCommand

ConfigDoc::GetRunCommand calls ConfigDoc::GetRunCommand

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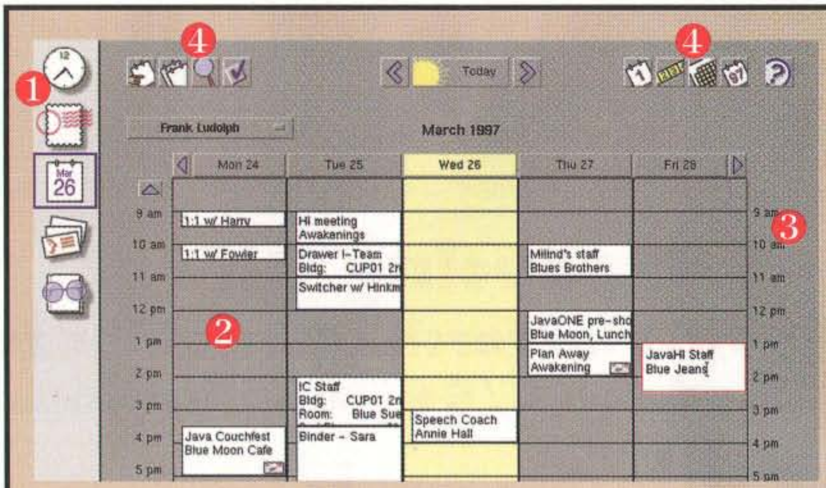

Sun's HotJava Views runs on Sun JavaStations or any system with a Java Virtual Machine.

1. The Selector is a task bar for switching applications.
2. CalendarView is the group scheduler.
3. Applications always run full-screen.
4. Buttons replace menus.

NUIs for NCs

Microsoft's dominance over desktop PCs is encouraging other developers to explore less competitive markets for their NUIs. The most promising alternative is the NC—by definition, a computer designed for network-centric computing. It's a wide-open frontier almost entirely devoid of Microsoft, although that's beginning to change, due to Microsoft's NetPC initiative, its recent acquisition of WebTV Networks, and hints that a future version of NT may include multiuser extensions. (See "Cheaper Computing," April BYTE.)

Not that NCs haven't attracted major players. IBM, Lotus, Oracle, SCO, and Sun are all introducing NUIs for NCs this year. But there's room for smaller firms, such as TriTeal and Ulysses, to sneak in, too.

NUIs for NCs tend to be simpler than retrofitted GUIs for PCs. They typically include a suite of small applications for workers who focus on a few basic tasks—which is appropriate, considering how organizations are likely to deploy NCs. They supplement those programs with Java, including applets that open gateways to legacy programs and databases. And they wrap everything together in a simplified interface that's easier for new users to learn.

"The majority of people in the world have never seen either the Macintosh or the Windows look and feel," says Douglass Wilson, the architect of Lotus's Kona Desktop. "We're aiming for a much broader market of corporate and home users who may never have seen any kind of GUI before."

Oracle and IBM are writing their NUIs in CPU-specific native code for maximum performance on low-cost microprocessors. Oracle's NC Desktop targets the Intel x86, the ARM 7500FE, and the Digital Equipment/ARM StrongARM processors. Those are the three CPUs that are supported thus far by Oracle's NC reference platform, a specification licensed by Network Computer, Inc. (NCI), an Oracle spin-off company.

IBM's still-nameless NUI targets the PowerPC 403 chip (an embedded version of the PowerPC 603 without an FPU) inside the IBM Network Station. Other vendors wrote their NUIs in Java, so they'll run on any system with a Java VM. That cross-platform compatibility comes at the expense of performance, although just-in-time (JIT) compilers and future Java chips will narrow the gap.

Sun Reinvents the GUI

Sun has probably spent more time rethinking the GUI than any other company. At JavaSoft (Sun's Java spin-off), designers Frank Ludolph and Don Gentner have analyzed what's right and what's wrong with every GUI from Windows to the Mac. It helps that Ludolph worked on the famous Alto project at Xerox's Palo Alto Re-

Morphing a NUI with SoftNC

TriTeal's SoftNC has a cool feature unique among NUIs–it can instantly change the appearance of its interface after a single mouse-click. To switch among styles that resemble Windows 95, Motif, or Unix CDE, users simply click on a button in a control panel. It's the neatest trick since the morphing metallic robot in Terminator 2.

SoftNC can change its look in this manner because the interface isn't hard-coded into the software. Instead, a proprietary description language that's similar to HTML controls the screen layout and the appearance of all the windows and widgets.

TriTeal's description language is called the SoftNC Presentation Language (SPL). An SPL script describes how a GUI should look, but it doesn't actually draw the graphics on the screen. To do that, TriTeal wrote its own library of Java classes. TriTeal's classes are broad enough to mimic almost any GUI and can adapt to different screen resolutions, color palettes, and screen types–even monochrome displays on hand-held devices.

The new classes reside on the SoftNC client (usually an NC). When SoftNC receives a message to change the desktop's appearance, it calls upon those classes to draw the interface described by the SPL script. The mechanism for these and other types of messages in SoftNC is based on the Inter-ORB Communications Protocol (IOCP).

Messages can originate locally or anywhere on a network. They are encoded as Multipurpose Internet Mail Extensions (MIME) attachments. A message might include some data and an SPL script, or a URL pointing to an SPL script elsewhere on the network. In this way, a server can centrally control SoftNC's desktop by dispatching MIME messages to all SoftNC clients.

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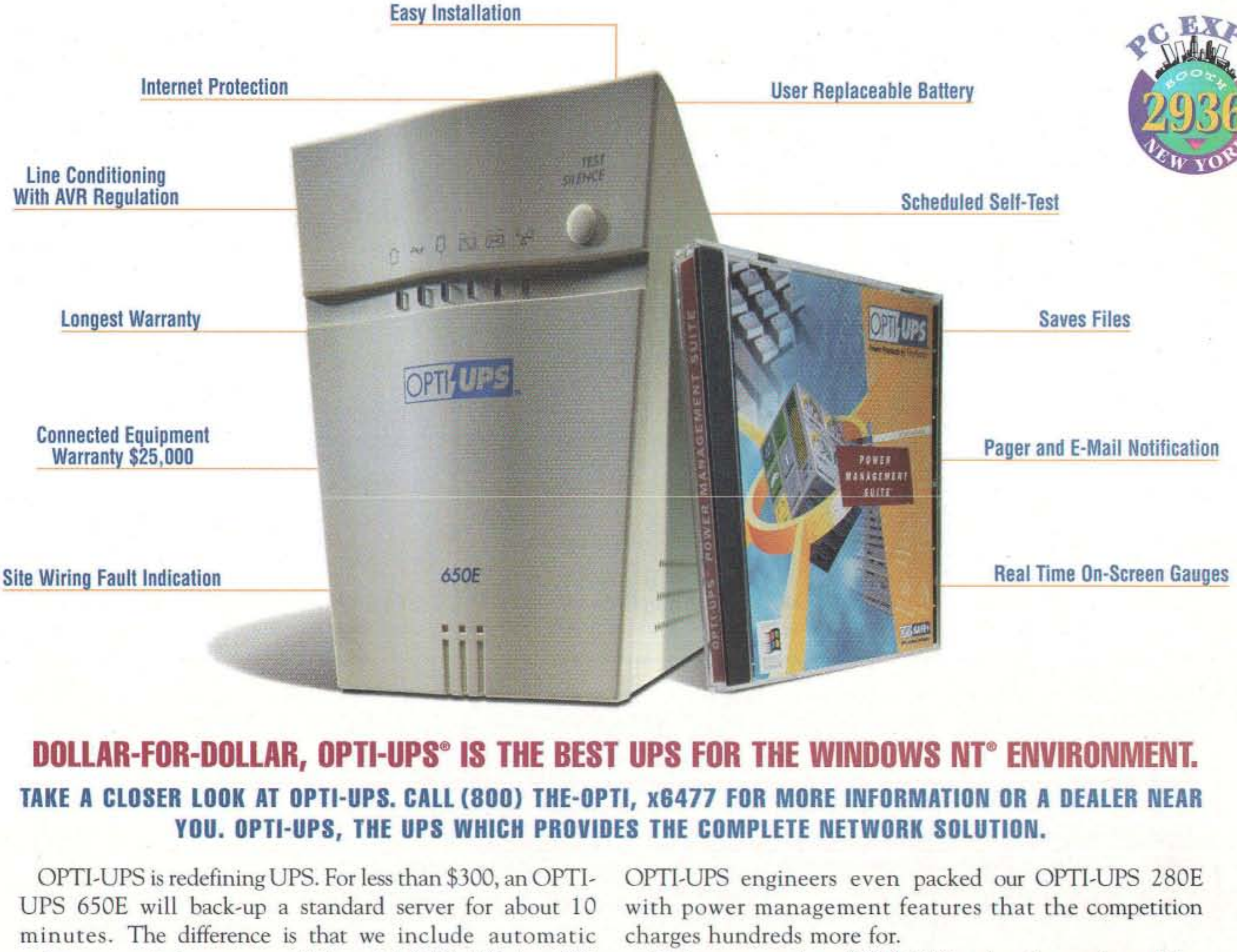
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search Center (PARC). Their innovative NUI for Sun's JavaStation, HotJava Views, tries to undo the complexity that has crept into GUIs since then, but without sacrificing too much flexibility.

Nothing is sacred to Ludolph and Gentner. The first thing they jettisoned was the menu bar. Menus—especially hierarchial ones—confuse new users with too many hard-to-find options, they argue. They boiled down the most essential operations into a few choices on a button bar.

Another substitute for menus is the Selector, a large task bar anchored at the left side of the screen. There's no need for a File menu with Open, Close, Save, Quit, and Exit commands. To users, all applications appear to be running all the time. They switch among them by single-clicking on icons.

Standard applications include MailView (e-mail), CalendarView (group scheduling), WebView (a browser), and NameView (directory services). Administrators can add more Java applets and applications to the Selector. When users switch tasks, the OS automatically saves the program's state on a server. When users return to a program, the original document appears just as they left it.

HotJava Views also does away with resizable, overlapping windows—a central metaphor in conventional GUIs. Instead, applications always run full-screen. This eliminates the confusion some users experience when a foreground window suddenly disappears behind another window. (Did the window close? Where did it go? How do I get it back?)

Future versions of HotJava Views will have fancier features: pop-up menus and sliding panels that appear along the edges of the screen. The pop-up menus are context sensitive, appearing only when users need them. The sliding panels are drawers for docking Java applets and displaying dynamic information downloaded over networks. Because the OS always preserves the NC's state on a server, users can access their customized environments and applications from any networked computer that's running HotJava Views.

Oracle: Better than Brand X

The software engineers at Oracle's NCI are taking similar liberties with long-held concepts. Their NUI, NC Desktop, bears a resemblance to HotJava Views and strives for the same kind of simplified interface.

The foundation of NC Desktop is NetBSD (a public-domain Unix kernel) and X11R6 (the latest release of the X Window System). NCI selected those components because they are free, well documented, thoroughly tested, and easy to port across different CPUs. However, NCI borrowed only the lightweight presentation layer of X, not the network graphics model. While X terminals rely on hosts to project graphics over a network, NC Desktop renders all graphics locally on the NC. This greatly reduces network loads.

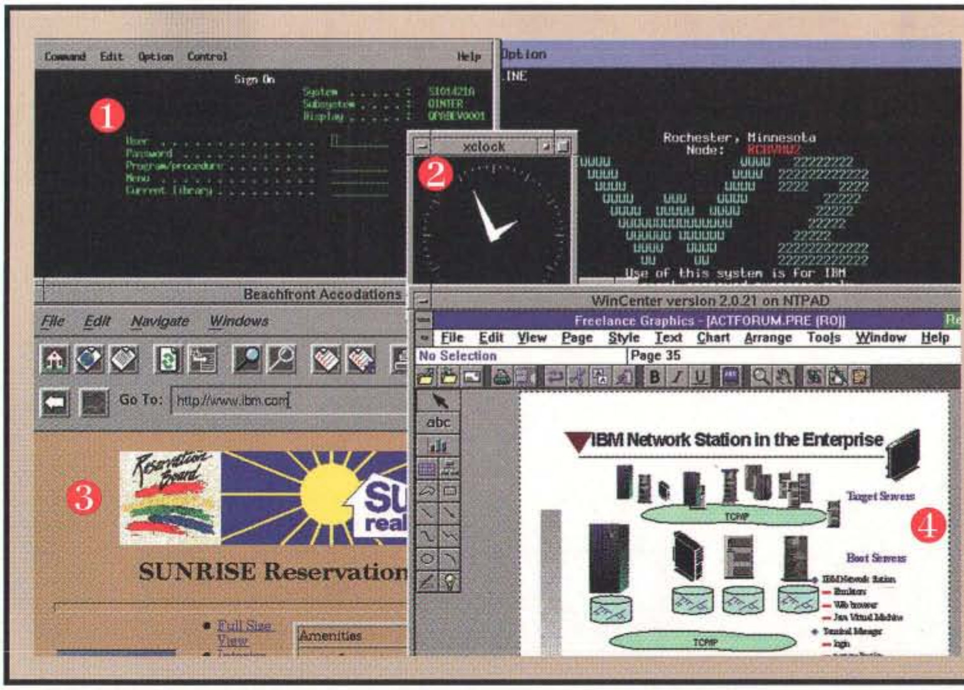
Another adaptation is that NC Desktop uses X only to display root windows and other basic screen elements. Inside the windows, the OS displays all documents in HTML. In effect, HTML is the standard display mechanism, somewhat like Display PostScript in NextStep. To support this, the OS has an HTML parser and converters for standard file formats, such as GIF, JPEG, MPEG, TIFF, AVI, AU, QuickTime, and Real Audio. There's also a Java VM and a JIT compiler.

Like HotJava Views, NC Desktop has a suite of miniapplications represented by icons on the left side of the screen. There's a Web browser, an e-mail client, an address book, a scheduler, a text editor, and a file manager.

In the current incarnation of NC Desktop, Java applets always run inside the Web browser. Stand-alone Java applications run on the desktop, just like native applications. At the bottom of the screen, an optional marquee displays streaming information (e.g., stock tickers and news feeds). Again, the goal is to bring dynamic information directly to the attention of users as soon as it changes rather than require users to manually browse for it.

Legacy Gateways

IBM, like Oracle, derived its NC-based NUI from a Unix kernel, wrote additional layers in native code, and added a Java VM. Given IBM's background in enterprise computing, it's no surprise that Big Blue



Command Edit Option Control Help
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File Edit View Page Style Text Chart Arrange Tools Window Help
No Selection
Page 35
IBM Network Station in the Enterprise
Target Servers
TCP/IP
Boot Servers
4

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System . . . . . :   S1014210A
Subsystem . . . . :   QINTER
Display . . . . . :   QPADEV0001
User . . . . . . . . . . . . . .
Password . . . . . . . . . . . .
Program/procedure . . . . . . . .
Menu . . . . . . . . . . . . . .
Current library . . . . . . . . .
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Use of this system is for IBM
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IBM's Network Station has a NUI written in PowerPC-native code. It emphasizes connectivity to legacy applications and data.

1. Terminal emulators are running "green-screen" applications on mainframes.
2. Another terminal program displays a Motif program running on a Unix server.
3. The Web browser.
4. A server-hosted Windows application.

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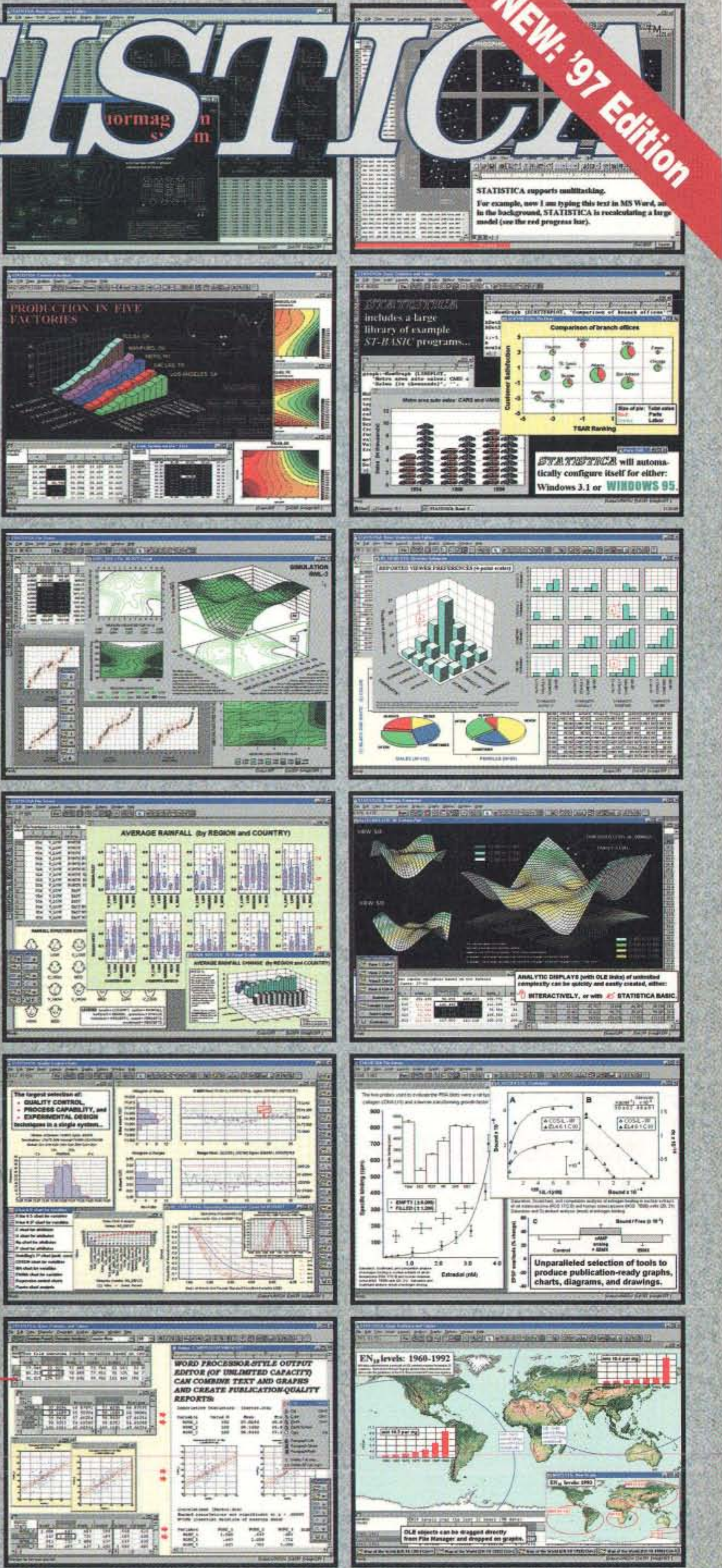
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The complete line of StatSoft products and training/consulting services are available from authorized [illegible] paid special attention to making its NUI work with legacy systems.

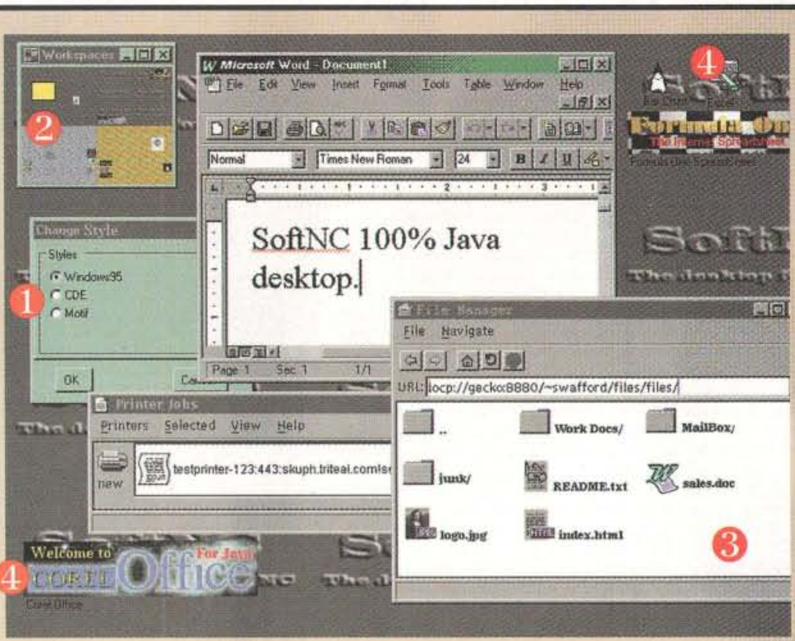
Native-code terminal emulators can simultaneously connect IBM's Network Station to multiple hosts. Users can remotely run 3270/5250 "green-screen" programs, Unix character-based programs, Unix Motif applications, or any Windows software.

Other NUIs can do similar tricks with Java-based solutions, such as SCO's Tarantella and Symantec's dbAnywhere. SCO is wrapping its Tarantella applets together with a simple NUI called the WebTop. It's a collection of HTML pages and applets that makes it easier for users to access legacy systems from a Web browser.

Lotus is writing its NUI, Kona Desktop (not the final product name), in Java. Like Netscape's Constellation, Kona is basically a full-screen browser that enables users to launch native applications as well as Java applets.

Although Lotus is still tinkering with the look and feel, Kona will probably have a static task bar on the left side of the screen (like HotJava Views and NC Desktop), no overlapping windows (like HotJava Views), and panels that display dynamic information (like virtually all NUIs). A ribbonlike "pager window" will allow users to send and receive brief messages.

Kona's built-in applications, like those in HotJava Views and NC Desktop, are simplified versions of the full-powered application suites that run on PCs. "These are lightweight versions of the applications in our SmartSuite," explains Kona architect Douglass Wilson. "They're aimed at the 80 percent of users who need 25 percent of the features. You wouldn't give this spreadsheet to a financial analyst—he'd probably need 1-2-3 or Excel—but you might give him this word processor."



SoftNC 100% Java desktop.

TriTeal's SoftNC, written completely in Java, can instantly change its look and feel to mimic three classic GUIs.

1. The control panel selects among Windows 95, Unix CDE, and Motif styles.
2. Users can maintain four independent desktops and switch among them by clicking on this panel.
3. The file manager resembles a Web browser.
4. Users can launch Java applets or native applications on the desktop.

Ulysses Telemedia, a dark-horse contender, is developing another Java-based NUI that blends the appearance and behavior of popular GUIs, such as Windows 95 and Motif. Ulysses' VCOS looks familiar to anyone experienced with PCs, but it subtlely changes the desktop's look and feel.

TriTeal's SoftNC has a control panel that lets users select from three different styles: Windows 95, Unix/Motif, and the Unix Common Desktop Environment (CDE). The entire desktop instantly changes when you select an option, because SoftNC has a unique mechanism for changing its interface on the fly (see the text box "Morphing a NUI with SoftNC" on page 68).

New Clients, New Users

Experienced PC users might find some of these NUIs too limiting—but then, NCs weren't designed for them. Just as NCs extend the client/server model to new types of client devices, the NUIs on NCs will extend computing to new kinds of users.

For half a century, computers have been evolving from solitary computational machines into smart communications devices. The hardware and the networks are finally coming together. Now it's time for the software to catch up—and it will change your screen forever. **B**

Tom R. Halfhill is a BYTE senior editor based in San Mateo, California. You can reach him at **thalfhill@bix.com.**

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Attention, Data-Mart Shoppers

For access to your most valuable data, you can build data marts from either the bottom up or the top down.

By Karen Watterson

Scenario #1: Your large corporation has an enterprise-wide data warehouse that contains all the information you need for your department—somewhere. Problem is, to isolate what you need, you're doing more slicing and dicing than Julia Child, more pivoting than Nijinsky, and more diving than Jacques Cousteau. Plus, your network administrator is giving you dirty looks for all the back-and-forth to the production server you're using that everyone wants a piece of.

Scenario #2: Your department or small firm would love to leverage the data in your database. But the price tag and effort of setting up a data warehouse keep you at the yearning stage.

Data warehousing is hot today because businesses realize that they can use information as a competitive weapon. The idea is to consolidate and aggregate data from production systems into centralized or distributed data warehouses or data marts, where users can get at it. Users can then use the data they obtain to, say, provide better customer service, do better analysis in a more timely fashion, or look at data in new ways that let them spot otherwise unknown problems or opportunities.

Two other compelling incentives for creating data warehouses and data marts are the ability to do data mining and then offering the resultant warehoused data over the Internet. The good news is that a data mart can meet the needs from either end: local access to pertinent data, for a cost and an amount of effort that won't kill you.

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Warehouses vs. Marts

Although word is spreading that data marts are definitely the way to go—they're less expensive and easier to build than enterprise data warehouses—the terminology itself can be an emotional issue (see the table "Data Mart or Data Warehouse?" on page 76). When Bill Inmon, cofounder of Prism Solutions and now head of his own data-warehousing company, Pine Cone Systems, first defined a data warehouse in 1990 as a "subject-oriented, integrated, time-variant, and nonvolatile collection of data supporting management's decisions," his vision of data warehouses was on an enterprise scale.

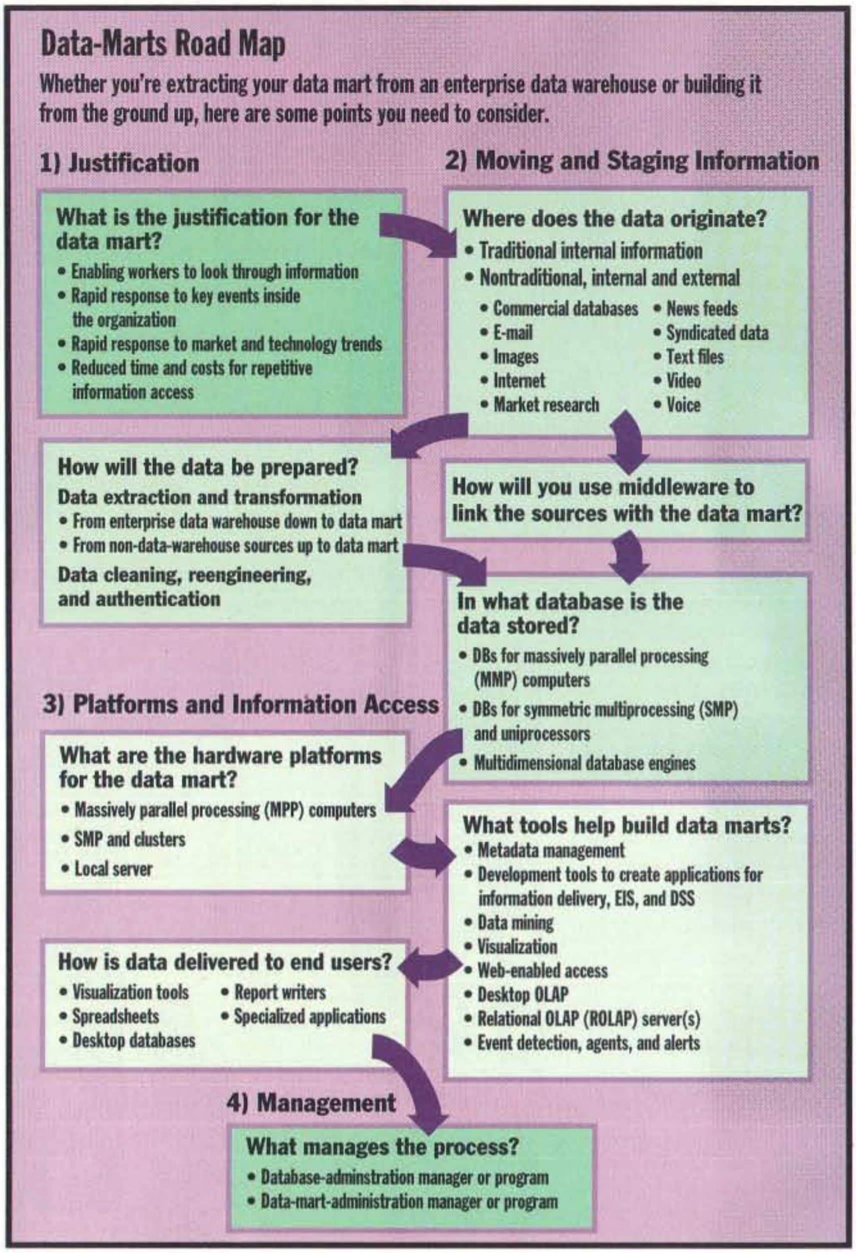
Today's more process-oriented definitions focus on warehousing rather than on warehouses or marts. *Warehousing* refers to a set of processes or an architecture that merges related data from many operational systems to provide an integrated view of data that can span multiple business divisions.

Data marts, on the other hand, tend to be subject- or department-oriented. They can be subsets of a larger warehouse (in which case they are called dependent data marts), but that's not a requirement, and many independent, "stovepipe" data marts exist. You can't even define data marts in terms of size—they aren't necessarily smaller than corporate warehouses. It's entirely possible, for example, for business-unit analysis to require so much historical depth that it's larger than the summary-level data available in the corporate warehouse.

The data-warehouse-versus-data-mart debate is one of those issues for which there's no simple answer. Some organizations insist that data marts are subsets of data warehouses and that you can't (and shouldn't) have any data marts until you pay your dues and create an enterprise data warehouse (and data model). Others say that, in today's fiercely competitive environment, you'd be crazy to embark on a multiyear warehousing project as a prerequisite to deploying any data marts. They believe it makes more sense to simply align a data-mart pilot project with an organization's core competency—the one that accounts for 90 percent of the firm's profits—and go for the more immediate results.

And given the relatively modest price tags of data marts, doesn't it make sense to view your first data mart as a throwaway? Fred Brooks, in his classic *Mythical Man Month*, says that "where a new system concept or new technology is used, one has to build a system to throw away, for even the best planning is not so omniscient as to get it right the first time." In other words, you should actually *plan* to throw one away—chances are you will anyhow.

Thus, a data mart is similar to a data warehouse that contains all of an organization's data, but it's more limited in scope. It typically focuses on the needs of a specific business unit or function and is less expensive and faster to implement than an enterprise-wide data warehouse. On the other hand, although data marts are less expensive, easier to start (especially given all the 30- to 90-day quick-start bundles), and often offer better performance than a gigantic data warehouse, they're often harder to scale up.



Data-Marts Road Map

Whether you're extracting your data mart from an enterprise data warehouse or building it from the ground up, here are some points you need to consider.

1) Justification

What is the justification for the data mart?
- Enabling workers to look through information
- Rapid response to key events inside the organization
- Rapid response to market and technology trends
- Reduced time and costs for repetitive information access

How will the data be prepared?

Data extraction and transformation
- From enterprise data warehouse down to data mart
- From non-data-warehouse sources up to data mart

Data cleaning, reengineering, and authentication

2) Moving and Staging Information

Where does the data originate?
- Traditional internal information
- Nontraditional, internal and external
  - Commercial databases
  - E-mail
  - Images
  - Internet
  - Market research
  - News feeds
  - Syndicated data
  - Text files
  - Video
  - Voice

How will you use middleware to link the sources with the data mart?

In what database is the data stored?
- DBs for massively parallel processing (MMP) computers
- DBs for symmetric multiprocessing (SMP) and uniprocessors
- Multidimensional database engines

3) Platforms and Information Access

What are the hardware platforms for the data mart?
- Massively parallel processing (MPP) computers
- SMP and clusters
- Local server

What tools help build data marts?
- Metadata management
- Development tools to create applications for information delivery, EIS, and DSS
- Data mining
- Visualization
- Web-enabled access
- Desktop OLAP
- Relational OLAP (ROLAP) server(s)
- Event detection, agents, and alerts

How is data delivered to end users?
- Visualization tools
- Spreadsheets
- Desktop databases
- Report writers
- Specialized applications

4) Management

What manages the process?
- Database-adminstration manager or program
- Data-mart-administration manager or program

Data Marts

From the bottom up...

If you want a simple data mart and have few data sources:

◆ Consider your primary relational database vendor, especially if the desired data is already on the database. IBM, Informix, Oracle, and Sybase offer low-price, scalable data marts.

◆ Look at other vendors' packages.

◆ Goals: simplicity, compatibility, low expense, expandability.

If you're building from scratch:

◆ Consider a vendor-supported methodology.

◆ Create an architecture, data models, and data mapping.

◆ Goals: low cost, suitable to task.

...or from the top down

If you have an enterprise-wide data warehouse:

◆ Choose data appropriate to your task.

◆ Set up a loading data mart with a subset of the data warehouse.

◆ Goals: Use an existing system, and select data that you can use.

The Three M's: Models, Methodologies, & Metadata

Still, there's a powerful incentive to get things right the first time. Where do you start? For simple data marts with few data sources, you might want to consider your primary relational database vendor, especially if the source data resides in an IBM, Informix, Oracle, or Sybase database already. Each of those vendors offers data-mart bundles for less than $100,000, scaling from Windows NT up to massively parallel processing (MPP) systems (see the table "Representative Vendors with Data-Mart Packages" on page 78).

However, the majority of data-warehouse and data-mart projects start with meetings that attempt to define scope, products, platforms, time lines, and budgets all at once. Sometimes it helps to have a methodology to follow. Most vendors offer some sort of methodology, perhaps in the guise of industry-specific templates or expertise, or their own best practices, but a few generic methodologies have also emerged.

Some methodologies, like Earl Hadden's, have even been licensed by data-mart vendors. Hadden's Data Warehouse Framework, based on John Zachman's framework for systems architecture, con-

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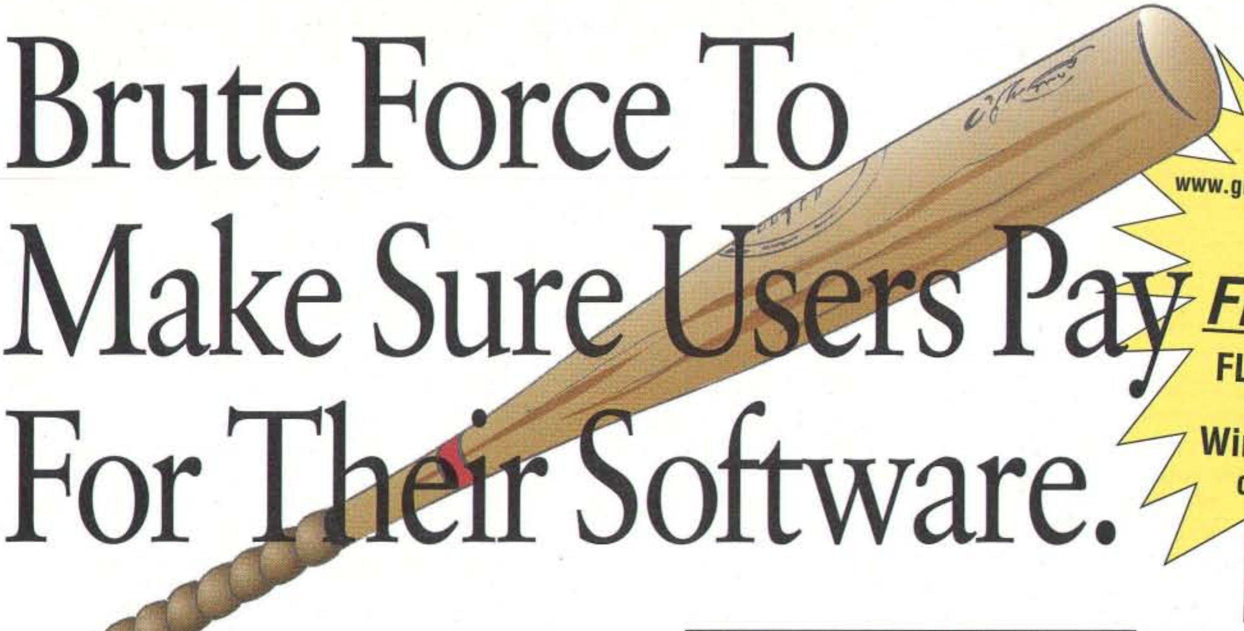

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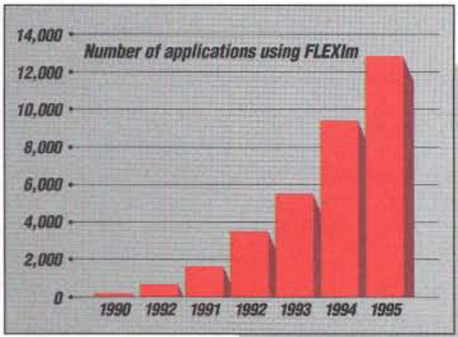

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FLEX*lm* is a registered trademark and "Electronic Commerce For Software" is a trademark of sists of a matrix with rows for owners, architects, designers, and builders, and columns for data, process, location, organization, event, and business driver. The Hadden Data Warehouse Method consists of three basic stages: architect, implement, and operate/enhance. Another well-known methodology is Prism's (http://www.prismsolutions.com) Iterations.

The architecture stage is typically the hardest, since it consists of identifying data sources, constructing a data model at both the conceptual and logical levels, and mapping the production data into the data warehouse or mart (i.e., constructing the physical model). Not surprisingly, traditional data-model vendors are beginning to offer help in designing data warehouses and marts. Powersoft's (http://www.powersoft.com) PowerDesignor (formerly called S-Designor), for example, includes a new WarehouseArchitect module for designing and building Sybase IQ data warehouses and data marts. Cayenne Software (http://www.cayennesoft.com) is another data-modeling vendor that offers help in designing data warehouses and data marts.

If you've heard about star schemas, on-line analytical processing (OLAP), or multidimensional database engines, you probably wonder where they fit into the data model. The term *OLAP* was coined by Ted Codd and Chris Date. Relational on-line analytical processing, or ROLAP, refers to engines and tools that add multidimensionality to data in relational database management systems (RDBMSes), using techniques such as star schemas.

The term *star schemas* refers to special database designs that make relational databases suitable for ad hoc slice-and-dice queries. Star schemas consist of fact and dimension tables, the idea being to mimic a multidimensional database with views of data (e.g., sales by region or time) that are likely to be explored. *Snowflaking* refers to splitting up the dimensions (i.e., decomposing them). Both star schemas and snowflaking result in databases that are denormalized and consist of redundant and precalculated data. Denormalization, a bad word in the production database arena, results in faster performance in data warehousing.

Data Mart or Data Warehouse?

	Data mart	**Data warehouse**
Size	Averages 50 GB; possibly as large as 250 GB	Often terabyte +
Purpose	Subject-area-specific	Enterprise repository
How initiated	Bottom-up	Top-down, along with formed enterprise data model
Control	Departmental	IS
Time line	3 to 6 months	1 to 2 years
Cost	$10,000 to $1,000,000	Millions of dollars

All warehouse products stash their metadata somewhere—often in the DBMS itself—but there aren't any widely accepted formats yet for metadata (data about data) interoperability and exchange. Fortunately, there are efforts currently under way (see http://www.metadata.org) to define such standards—something that will become increasingly useful as organizations seek to consolidate independent data marts, integrate business-to-business data sharing over the Internet, and handle "inherited" data marts and data warehouses that result from mergers or acquisitions. As you'd expect, the growing field of data-warehouse management tools focuses on metadata.

It should be obvious, but the more time you spend on doing a good, centrally administered data model, the easier it will be to deploy additional data marts and consolidate them into a consistent data warehouse—if that's your organization's ultimate goal. The danger with deploying multiple independent data marts with inconsistent data models is that not only must they be independently refreshed, but you'll also have to maintain multiple sets of probably inconsistent metadata.

Additional Resources

At last count, there were over 30 books on data warehouses. Two stand out as good "starter recipes": Ralph Kimball's The Data Warehouse Toolkit: Practical Techniques for Building Dimensional Data Warehouses (1996, ISBN 0-471-15337-0, with CD-ROM) and The Data Model Resource Book: A Library of Data Models and Data Warehouse Designs (1997, ISBN 0-471-15364-8), by Len Silverston, Bill Inmon, and Kent Graziano.

Another extremely useful pamphlet, which is available free from Cognos (http://www.cognos.com), is Multidimensional Manager: 24 Ways to Impact Your Bottom Line in 90 Days, by Richard Connelly, Robin McNeill, and Roland Mosimann.

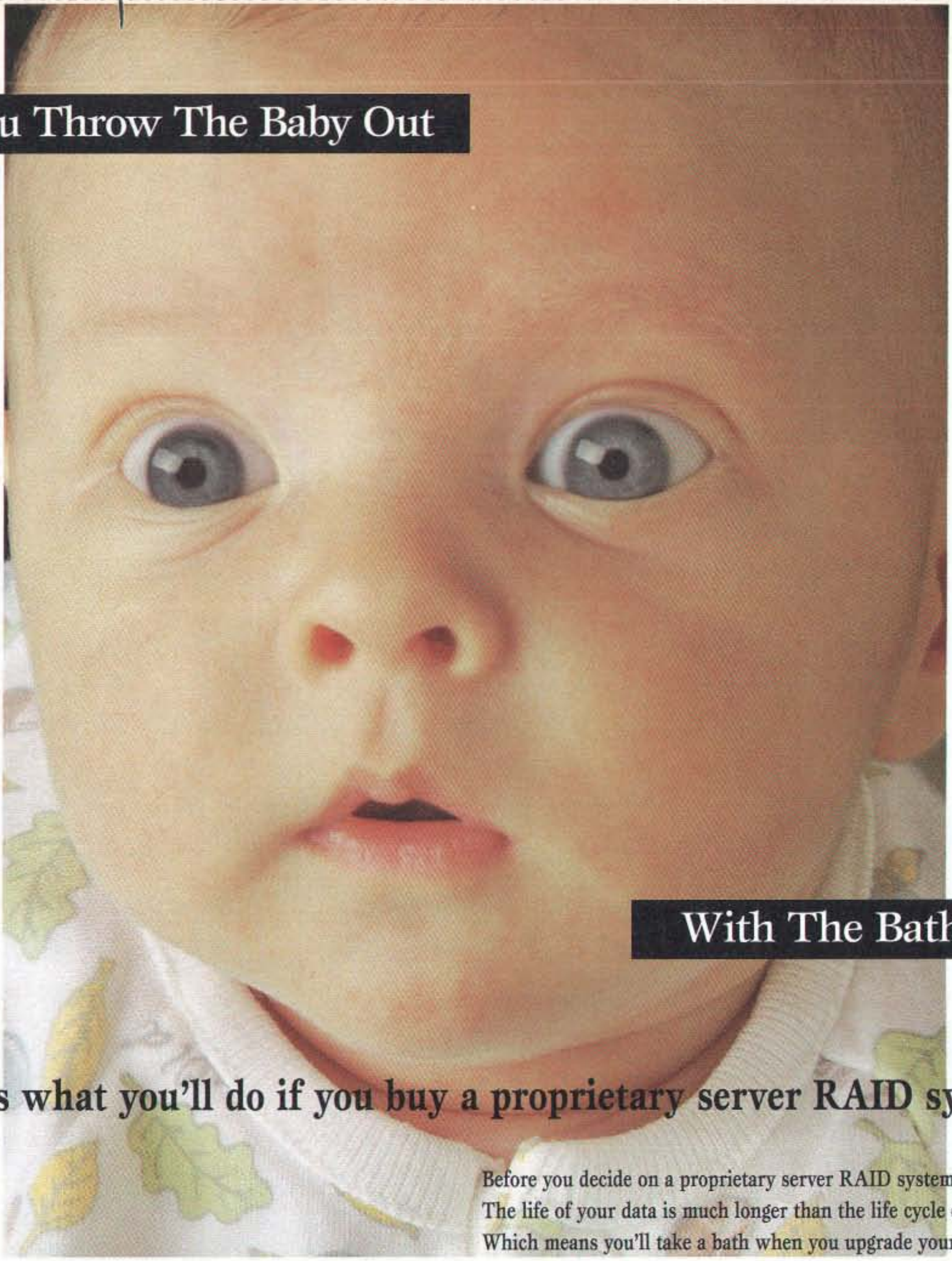
Larry Greenfield maintains an excellent Web site (http://pwp.starnetinc.com/pwp/larryg/index) on data warehousing, and U.K.-based market-research firm Spectrum Reports also has good how-to papers and reports at http://www.aladdin.co.uk/mw_spectra/collectn/database.htm. The Applied Technology Group (ATG, http://www.techguide.com) maintains an excellent collection of downloadable technical guides on data-warehousing and data-mart topics, such as right-sizing and assessing storage options.

There are also two good organizations, each with over 3000 members, devoted to the area. One is The Data Warehousing Institute (TDWI, http://www.dw-institute.com). Membership cost is $195 per year within the U.S.; outside the U.S., the cost is $245. The other organization is DCI's IDWA (http://www.idwa.org), which has a membership cost of $100 per year. TDWI also offers an excellent poster on data-warehousing products and maintains a fax-back list of available white papers.

Process Steps: Data Cleansing and Loading

You might think that doing the data modeling and mapping is the hardest part of building a data warehouse or mart. But more often than not, the data-cleansing step is even more time consuming. The sad truth is that most corporate data contains not only erroneous data, but also data with inconsistencies that are extremely hard to resolve.

One of the hardest things to accept when building a data warehouse or mart is deciding how clean is clean enough; that's something that varies, depending



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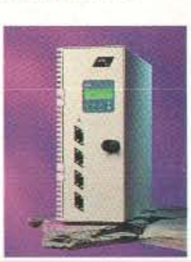

Representative Vendors with Data-Mart Packages

Vendor	Package	Starting price	Web address
Arbor Software	Essbase	$37,000	http://www.arborsoft.com
Digital Equipment Corp.	Digital Data Mart (uses Informatica's PowerMart)	$99,500	http://www.digital.com
Fiserv, Inc.	InformEnt (for banks)	Client-specific	http://www.fiserv.com/inform
IBM Corp.	Visual Warehouse for Windows NT	$22,500	http://www.software.ibm.com
IBM Corp.	AS/400	$7995	http://www.as400.ibm.com
Informatica	PowerMart	$50,000	http://www.informatica.com
Information Advantage	DecisionSuite	$29,995	http://www.infoadvan.com
Information Builders, Inc.	SmartMart	$55,000	http://www.ibi.com
Informix Software	Informix FastStart Data Mart (includes MetaCube)	$62,500 (Informix Online Workgroup Server alone starts at $1475)	http://www.informix.com
JDA Software Group, Inc.	Retail Ideas (AS/400 solution)	Varies	http://www.jda.com
Kenan Technologies	Acumate ES	$25,000	http://www.kenan.com
Microsoft Corp.	SQL Server	$1499	http://www.microsoft.com
MicroStrategy	DSS Server	$50,000	http://www.strategy.com
Oracle	Oracle Server for NT/ Oracle Express Server for NT	$1475/$3995	http://www.oracle.com
Prism Solutions	Prism Scalable Data Mart	$70,000	http://www.prisminc.com
Red Brick	Red Brick Warehouse	$5000	http://www.redbrick.com
Sagent Technology	Sagent Data Mart Solution	$50,000	http://www.sagenttech.com
SAS	Rapid Warehouse Assessment, SAS/Warehouse Administrator	$15,000	http://www.sas.com
Seagate/Holistic Systems	Holos	$88,000	http://www.holos.com
Sequent Computer Systems	CompleteWarehouse	$500,000 (hardware and software)	http://www.sequent.com
Siemens Pyramid Information Systems	Smart Warehouse	$25,000	http://www.siemens-pyramid.com
Software AG	Dmart and SourcePoint	$25,000	http://www.sagus.com
Sybase	WarehouseNow, formerly called QuickStart DataMart (uses Informatica's PowerMart)	$95,000	http://www.sybase.com
Virtual Integration Technology	designManager and deliveryManager	$50,000 per server	http://www.vit.com
VMark Software	DataStage	$37,500	http://www.vmark.com

on what the data warehouse or mart is to be used for. Some implementers simply rely on the classic "80/20" rule. Although the idea of 20 percent "bad" data might shock you, it's not uncommon for real data warehouses to start with 40 percent problematic data. Keep in mind also that data cleansing isn't a one-time deal. After all, whenever you refresh, or update, your data warehouse or mart, you have to go through the same data-cleansing steps to maximize data quality.

Like data cleansing, data loading is something that happens more than once. It's also something that you have to monitor, because it can impact operational systems (after all, you use production-server CPU cycles to copy data out to the data warehouses or marts) and the network traffic. Users want data that's as up-to-date as possible, but network managers and on-line transaction processing (OLTP) system managers undoubtedly encourage moderation. It takes a lot of bandwidth to maintain near-real-time data marts.

If you think about how data marts and warehouses get loaded up with data—hourly, daily, or weekly—you can see how fast they can grow. That's one reason why it's smart to have an upward migration plan in hand from the onset. You'll probably also have to archive old data-mart or warehouse data, or simply decide to keep only the most recent data—say, three months' worth—in your system.

By now it should be clear that building a data warehouse or mart isn't easy and that it's an ongoing task. Users want more data, faster response, and perhaps even increasingly powerful tools as they become more adept at slicing, dicing, and otherwise analyzing your organization's data. And sooner or later, someone will want to Web-enable your data warehouse or mart. Next aisle, please. **B**

Karen Watterson (San Diego, CA) is an independent writer and consultant who specializes in client/server and data-warehousing issues. You can contact her by sending e-mail to **1119390@mcimail.com.**

A Virtual Private Affair

Virtual private networks offer some serious savings—if you know the secret.

By Mike Hurwicz

Do you always get what you pay for? Buy a Lexus, get reliability. Buy a Yugo, get a future home for Bondo. Right? Maybe. The Internet provides WAN communications more cheaply and more globally than a leased line, Frame Relay, or asynchronous transfer mode (ATM) network. Unfortunately, it can't provide the security, bandwidth, or quality of service (QoS) guarantees typically associated with private networks. In addition, the Internet supports only TCP/IP, while most networks accommodate a variety of protocols. So if you try to run your corporate net over the Internet, you pay less but get an inferior service.

Then again, maybe not. Internet service providers (ISPs), equipment vendors, and software developers say they can give you the best of both worlds: the security, performance, availability, and multiprotocol support of a private network over the inexpensive and pervasive Internet. It's called a virtual private network (VPN), or "extranet," and the technology is currently being considered primarily as a means of extending the reach of private networks for dial-in access. But connections with business partners and customers are another important application. And, to a lesser extent, VPNs may address locations where traditional private network connections cannot be economically justified. Some vendors and service providers are talking up the idea of replacing existing private network links with VPN links.

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But VPNs (and IP tunneling, one of the underlying technologies) raise several challenges. Foremost, how do you deal with issues of QoS? How do you handle non-IP traffic? How do you authenticate and assign IP addresses? And how secure are they?

How Does It Work?

There are two main architectures for setting up a tunnel: client-initiated or client-transparent. Client-initiated tunneling requires tunneling software both for clients and for tunnel servers (or gateways). The latter typically reside at the corporate central site, though they could reside at the ISP point of presence (POP) that serves the central site. With client software to initiate the tunnel, and the tunnel server at the corporate site to terminate the tunnel, the ISP doesn't have to support tunneling in any way. The client and the tunnel server simply establish the tunnel, using authentication based on a user ID and password and perhaps on a digital certificate. The client and the tunnel server may also negotiate encryption. Once the tunnel is established, communications proceed as if the ISP were not mediating the connection.

On the other hand, if you want tunneling to be transparent to the client, the ISP's POPs must have tunnel-enabled access servers and perhaps routers. The client first dials in to the access server, which has to recognize (based on a user ID, for instance, or on the user's choice from a menu) that this connection should be tunneled to a particular remote location. The access server then establishes the tunnel with the tunnel server, typically using the user ID and password for authentication. The client then establishes a session directly with the tunnel server via the tunnel, just as if the two were directly attached. While this has the advantage that no special software is required on the client, the client can dial only into properly equipped access servers.

During 1996, two tunneling protocols competed for users' attention: Microsoft's Point-to-Point Tunneling Protocol (PPTP) and Cisco's Layer Two Forwarding (L2F). The essential technical difference between the two is that PPTP tunnels by wrapping PPP packets in IP, a Layer Three protocol, while L2F, as its name implies, uses Layer Two protocols, such as Frame Relay and ATM, for tunneling.

PPTP can be client-initiated (and transparent to the ISP) or client-transparent. In either case, it is currently NT-only: It requires both an NT client and an NT server. In contrast, L2F requires support in access servers and routers; thus the ISP has to support L2F. In its defense, L2F provides some things PPTP doesn't, such as authentication for tunnel endpoints (i.e., between the access server and the tunnel server).

A major advantage of PPTP is Microsoft's support for it. Both a client and a tunnel server for PPTP were shipped in NT 4.0. A Windows 95 client is planned. Another advantage is PPTP's support for flow control, keeping clients and servers from getting overwhelmed by traffic and enhancing performance by minimizing dropped packets and thus retransmissions. However, PPTP requires IP (though it can tunnel IPX and NetBEUI, as well as PPP), and it doesn't include authentication for tunnel endpoints. PPTP, leveraging PPP, relies on user authentication. In addition, some analysts think PPTP may not scale as well as hardware-based solutions such as L2F.

Recognizing the merits of each others' protocols, Microsoft and Cisco agreed late last year to merge their competing protocols into Layer Two Tunneling Protocol (L2TP), which is supposed to offer the best of PPTP and L2F. Secure IP, or IPSEC, is expected to be commonly used to coordinate encryption between L2TP endpoints. (Standardized encryption has not been a feature of PPTP or L2F.) L2TP will also support multiple simultaneous tunnels for a single client. Multiple concurrent tunnels may be important in the future, when tunnels support bandwidth reservation and QoS.

These aren't the only tunneling protocols around. For instance, in its BayStream Dial VPN Services, Bay Networks uses Mobile IP for tunneling, avoiding both PPTP and L2F. Bay Networks will support L2TP and IPSEC as those protocols mature. BayStream Dial VPN Services is designed to allow ISPs to offer VPNs to customers, with no modifications of clients or at central sites. Dial VPN Services is a feature of the Bay Networks 5000 Multi-Service Access Switch, Remote Annex remote access concentrator family, and Backbone Node router platform.

As another alternative to PPTP and L2F, NEC has been evolving SOCKS, an authenticated firewall traversal protocol, designed to permit a data stream to cross a firewall based on user authentication rather than on the characteristics of the IP packet. Developed in 1990, SOCKS is now an IETF standard (RFC 1928, 1929, and 1961). Version 5 includes encryption negotiation.

Security Problems

For intra- and intercompany VPN traffic, considerations such as security, availability, reliability, and performance may force organizations to consider exactly where their traffic flows and what other traffic uses the same networks. Primary among these considerations is security. Security issues include privacy (transmissions cannot be read), authorization (users have the right to access certain resources), integrity (data isn't tampered with), nonrepudiation (senders are who they say they are), and assurance of service (the ability to send or receive data cannot be denied). Except for denial of service, all these concerns can be addressed through encryption and digital keys. However, costs associated with keys and encryption may include processing power, network bandwidth, special hardware, and time and expertise to manage the system. Instead of incurring those costs, organizations may choose to use private networks, which they typically perceive as needing less investment to achieve a higher level of security.

You can question to what extent, if at all, Internet traffic is more vulnerable to various kinds of attacks. For instance, if the same physical lines carry Internet and private network traffic, both types of traffic may be equally vulnerable to "invasion of privacy" via a network monitor. In this context, notes Dataquest analyst John Coons, encrypted VPNs may be more secure than private lines.

Most other types of attacks, however, are easier to mount on the public Internet than on a private network. The reason is simple: It's difficult for a perpetrator to insert traffic into a private network, but it's easy on the public Internet. Attacks that require the ability to transmit include password-guessing attacks, data tampering, and "spoofing" (pretending to be an authorized user by forging an authorized address on packets).

An attack that aims at denial of service can be particularly hard to defend against, even if a company is willing to spend money on security: For instance, a perpetrator can bombard a particular address with traffic, tying up communications and processing resources at that site. Recent perpetrators have been crashing servers, routers, and printers using the Ping of Death attack, which involves sending a ping message that is larger than legal size. If a firewall blocks ping messages, there are ways to accomplish the same thing via the HTTP, NFS, or Telnet protocols. Intruders will, unfortunately, always find a way.

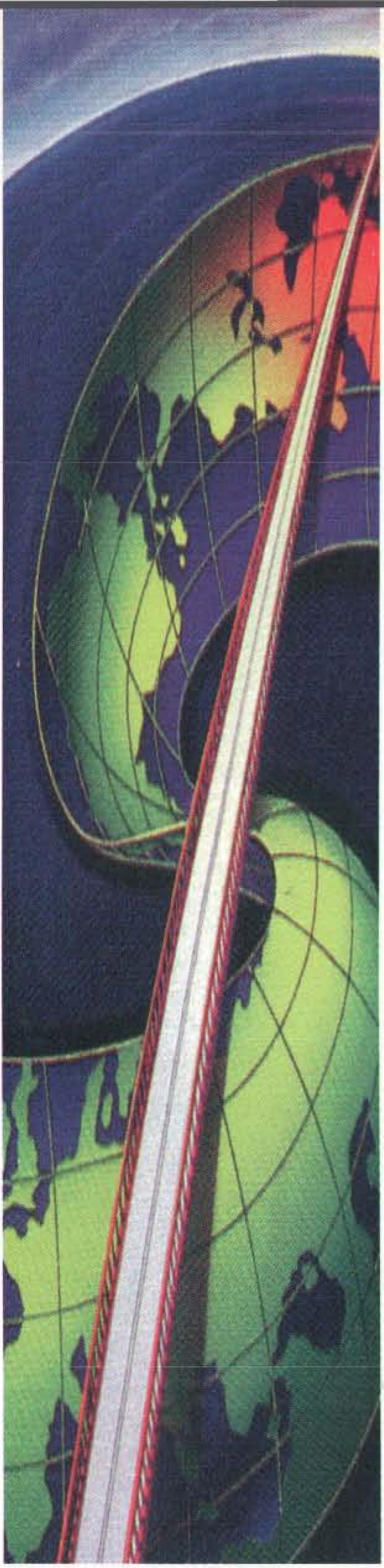
Among SOCKS's advantages are support for Unix and NT, plug-in support for many authentication and key management methods, and a unidirectional security architecture that allows you to tunnel to another network while minimizing your exposure to attack from that network. In addition, SOCKS operates at the TCP level, making it easier to establish application-specific tunnels for applications associated with a particular TCP port.

Any firewall can be configured to pass SOCKS traffic transparently. Native SOCKS support allows a firewall to originate and terminate a SOCKS data stream. Although none of the three top firewalls—Trusted Information Systems' Gauntlet, Check Point's FireWall-1, or Raptor Systems' Eagle—supports SOCKS natively today, analysts at the Gartner Group predict that all the leading firewalls will support it by 1998. Aventail's MobileVPN and PartnerVPN use client-initiated SOCKS tunnels.

So far, IPSEC and L2TP have captured the market's attention far more than SOCKS has. "I don't know of anyone trying to create interoperable VPNs based on SOCKS," says Ira Machefsky, an analyst with the Giga Information Group. On the other hand, it was only with the recently introduced SOCKS version 5 that it became easy to "socksify" clients. Before, the client code had to be recompiled to support SOCKS. With SOCKS v5 and technology such as Aventail's Autosocks, unmodified clients can be instantly socksified. "If SOCKS had had this capability two years ago, it would have been a slam dunk [for SOCKS to gain widespread success as a VPN standard]," says Michael Zboray, an analyst with the Gartner Group. "Now, only time will tell whether the technical advantages of SOCKS will be sufficient to overcome the momentum of IPSEC and L2TP."

Quality of Service

The technologies for low-cost, Internet-based VPNs are maturing. But you still may have trouble finding an ISP willing and able



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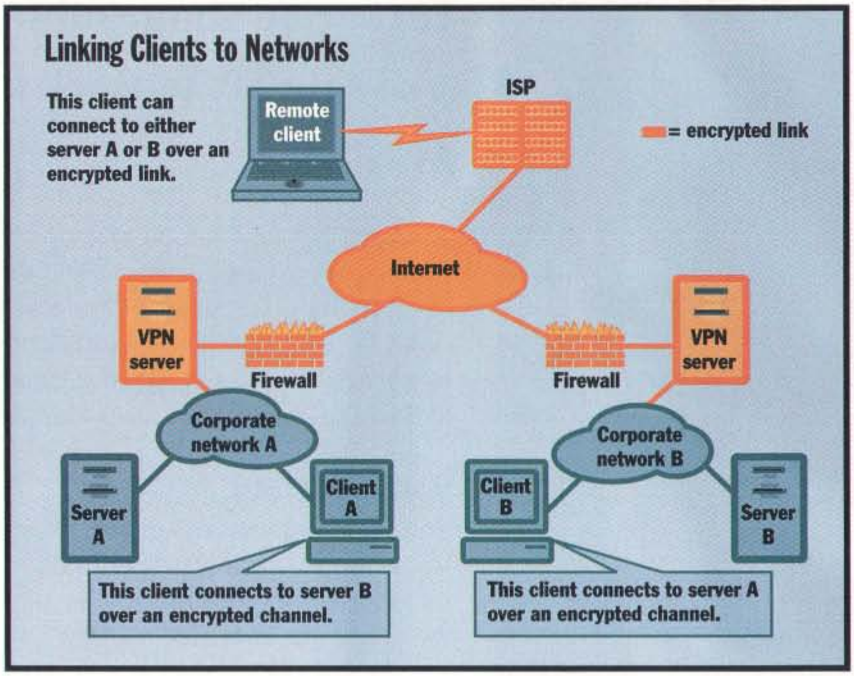
to manage your VPN for you. There are still many outstanding questions. How do you guarantee the quality of service? And how are ISPs to charge for VPN traffic?

Right now, few ISPs support QoS. New technologies such as Resource Reservation Protocol (RSVP) address the QoS problem, but they can't undo this basic reality. RSVP enables users to manage QoS, but RSVP only requests guaranteed bandwidth or a given delay/latency or error rate; it's up to the ISP to fulfill the request, and many ISPs can't handle RSVP. Even if they could, ISPs must be able to charge more for high-priority packets than for low-priority packets before they will roll out the service.

"We may have to start charging for usage," says Vint Cerf, senior vice president of data architecture at MCI Communications, a major carrier of Internet traffic. "As the system becomes bigger, it gets more difficult to make things flat-rate. In addition, we might well have different charges based on quality of service. Ideally, charges should reflect the amount of resource consumed to deliver a service."

And this is just intra-ISP QoS. Even when ISPs have direct network connections among themselves in order to speed traffic flows, they typically have no agreements covering reliability, availability, or QoS. Eric Paulak, senior analyst with the Gartner Group, expects such "network interface" agreements for private networks, such as Frame Relay networks, early in 1998, along with the introduction of switched virtual circuits (SVCs) that make it easy to connect Frame Relay networks from different carriers. Network interface agreements for Internet services may come later in 1998, says Paulak.

However, such agreements will require billing arrangements and perhaps protocols that do not yet exist. "If ISP 'A' carries high-priority traffic for ISP 'B,' ISP 'A' needs to get remunerated for allocating those resources," says John Coons, director and principal analyst of wide-area networking at Dataquest. It could be mid-1999 before ISPs have the protocols and billing arrangements in place to make that possible, Coons thinks. Right now, he points out, ISPs typically don't even have mechanisms to bill for classes of service within their own domains.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Corporate network A
Server A
Client A
This client connects to server B over an encrypted channel.
Firewall
VPN server
Corporate network B
Client B
Server B
This client connects to server A over an encrypted channel.

Virtual private networks (VPNs) run over the Internet and transparently encrypt the links between end points.

For now, if you want end-to-end service guarantees, you'll probably have to stick with a single ISP. Even at that you'll have to choose your ISP carefully since many offer little or nothing in the way of service guarantees. And even with service guarantees, having to stick to one ISP discourages the use of VPNs because a company may have little influence over the ISP selected by its suppliers, customers, or partners. Even if a company does have such influence, a single ISP cannot offer the ubiquitous access associated with the entire Internet. (Some, such as CompuServe, UUNet, and MCI, come closer than others.)

Dial-In Cost Savings

But even with QoS questions outstanding, many companies are interested in Internet-based VPNs. As well they should be: The cost of a VPN may be less than half that of a private dial-in access solution.

Today, companies typically use in-house communications servers, modem banks, and toll-free numbers to support dial-in access. It works, but there are some catches. The equipment is frequently being upgraded to faster modems, ISDN, or even digital subscriber line (DSL). Furthermore, carrier offerings and tariffs change continually. These changes cost both money and management effort. Even in stable configurations, dial-in connections are notoriously finicky.

Economies of scale make it more cost-effective for ISPs to maintain all the dial-in connections at the POP rather than each company maintaining its own. Similarly, it's more economical for ISPs to maintain huge, highly utilized backbone pipes than for each company to maintain a smaller, less fully utilized pipe. The way Internet services are packaged may be more efficient in terms of sales and operations.

Using a VPN, companies can off-load most of the expense and hassle associated with dial-in connectivity: Users simply dial in to the closest ISP POP. The ISP manages the modem banks and communications servers and thus makes the bulk of the investment in access technologies. The ISP forwards the dial-in traffic to a central corporate site via the VPN. At the central site, the corporation maintains a single connection to the Internet, usually via a high-speed digital line such as a T1. Dial-in traffic looks like ordinary Internet traffic coming in on the high-speed digital access line. Functionally, remote users have the same connection to the corporate network as if they were sitting at their desks at the central site.

Partner VPNs

After dial-in access, connection to business partners is the major advantage of Internet-based VPNs over private networks. Rather than leasing lines directly to major partners and customers, you can

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use your existing Internet connections to send VPN traffic to one another.

For intracompany traffic, on the other hand, a VPN typically has no price advantage over Frame Relay for equivalent service, says Gartner's Paulak. The logic behind this assertion works like this: The same basic telecommunications infrastructure provides both Internet and private network services, so they have part of their cost structure in common. Beyond that, carriers or ISPs may have to charge for the additional services they offer, including reliability, availability, and QoS.

UUNet's ExtraLink is an example. At one point, ExtraLink, which used UUNet's underlying Frame Relay network, cost about 30 percent more than ordinary Frame Relay, says Paulak. UUNet started with the same basic cost that any carrier has for maintaining a Frame Relay network. Then UUNet added IP routing and security. Naturally, the company had to charge more. Other carriers, such as AT&T, offer "managed" Frame Relay services, which include IP routing and security, for only about a 15 percent premium over ordinary Frame Relay.

Such managed Frame Relay services will not connect you to other companies' Frame Relay networks, however, while UUNet will connect multiple companies to the same ExtraLink network. For connecting to suppliers, business partners, and customers, a service like ExtraLink can make a lot of sense.

If VPNs help ISPs capture a larger market share, the ISPs may be able to lower their prices. VPNs often support applications with higher duty cycles than typical Internet access, notes Skip Taylor, group manager of remote access services for CompuServe Network Services. Such applications, including work-at-home programs, remote access, nomadic users, and cross-functional teams in different locations, can generate consistent traffic loads that can justify higher-bandwidth backbones. Unit price decreases as volumes increase and backbones are more fully utilized, observes Taylor. In March, CompuServe began testing an IP-based VPN service that will be rolled out in 10 to 15 major metro areas over the year.

Business customers, according to Gartner analysts, are most interested in the tightly controlled VPN services offered by a single ISP, such as CompuServe or UUNet. However, these services are more or less identical, from the customer's point of view, to services that these same ISPs have been offering for years. In both cases, the customer dials in over an async line using PPP and is connected securely and reliably to a central site.

Are these ISPs, then, pulling a bait and switch, luring the customer with the term "VPN," which implies more ubiquitous access and lower prices, then delivering business-as-usual access and prices with new terminology? Initially it may look that way. But over time, these services will evolve to provide a level of interoperability beyond what has been possible.

Multiprovider VPNs

As protocols like IPSEC, L2TP, and SOCKS mature, ISPs will be able to interconnect tunnels more easily. With network interface agreements to ensure availability and quality of service, ISPs will be able to offer VPNs that span multiple providers without giving up the service guarantees that are associated with single-provider VPNs today. However, you probably won't see many multiprovider VPNs before 1998.

Meanwhile, organizations can implement their own multi-ISP VPNs with guaranteed performance by using customer premises equipment if they can get service guarantees from the individual ISPs. For example, customers can:

- Set up client-initiated tunnels via multiple ISPs
- Encrypt those tunnels
- Implement a system of digital keys for authentication and nonrepudiation

Security Solutions

IPSEC, or secure IP, is the emerging standard for safeguarding Internet-based virtual private networks (VPNs). IPSEC is a family of protocols described in some 17 Internet Engineering Task Force (IETF) draft documents, the most important of which are RFCs 1825 through 1829. A mandatory requirement for a compliant implementation of IPv6, IPSEC defines protocols for authentication, privacy, and data integrity at the IP or kernel level, using two optional IP headers: Authentication Header (AH), which supports authentication and data integrity, and Encapsulating Security Payload (ESP), which insures privacy.

These fundamental protocols were agreed upon in 1995 and tested during 1996. However, agreement lagged on how to establish security associations, agree on encryption algorithms, and exchange public keys. These functions are critical for interoperable authentication, authorization, data integrity, and nonrepudiation.

Key management will be an important feature of IPSEC. The X.509 standard defines a format for digital certificates, but it does not say how two nodes can establish a security association and agree on an encryption key for a particular session. Throughout most of last year, debate continued within the IPSEC working group over whether such key management functions should be based on Simple Key Management for Internet Protocols (SKIP), developed by Sun Microsystems, or Internet Security Association and Key Management Protocol (ISAKMP)/Oakley, which has been favored by Cisco Systems.

SKIP is easier to implement and imposes less overhead when a security association is established. In fact, if each host already has the other host's public key certificate, SKIP doesn't have to exchange any packets to establish a shared key for a particular association. The data packet itself will contain enough information for the receiving host to compute the shared key. This can be important where associations are created and destroyed relatively frequently. It's also important when a host reboots, for instance, and has to re-establish all its security associations.

Unfortunately, typical implementations of SKIP do not allow for much negotiation of encryption algorithms, such as Data Encryption Standard (DES) and triple DES, or of other options for insuring data integrity, such as using Message Digest 5 (MD5) or Secure Hash Algorithm 1 (SHA-1) hashing techniques. That means that if a node using SKIP cannot decrypt a packet, there is no means within SKIP to recover. Messages typically must be sent outside the protocol to indicate the failure. However, there is no assurance that such messages couldn't be forged, allowing an attacker to disrupt communications.

ISAKMP/Oakley supports more negotiation and is therefore more robust and secure. In the fall of 1996, ISAKMP/Oakley was selected as the basis for the Internet Key Management Protocol (IKMP), the mandatory IPSEC key management protocol. SKIP is now an optional IPSEC protocol. ISAKMP/Oakley and SKIP implementations were tested at an IPSEC "bake-off" in late March. IKMP should go to the IETF in July.

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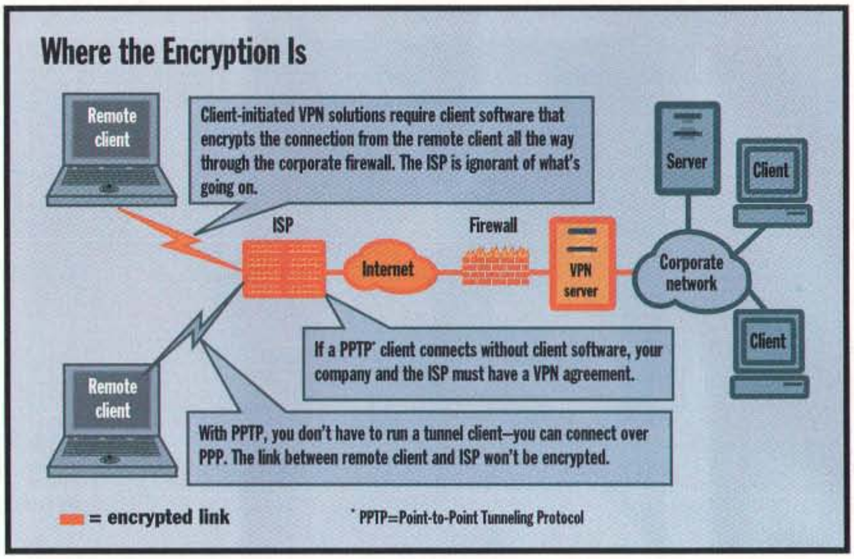


Client-initiated VPN solutions require client software that encrypts the connection from the remote client all the way through the corporate firewall. The ISP is ignorant of what's going on.

If a PPTP* client connects without client software, your company and the ISP must have a VPN agreement.

With PPTP, you don't have to run a tunnel client—you can connect over PPP. The link between remote client and ISP won't be encrypted.

▬ = encrypted link

*PPTP=Point-to-Point Tunneling Protocol

With Point-to-Point Tunneling Protocol (PPTP), a remote client does not have to run special VPN software.

- Configure routers and firewalls to prevent unauthorized users from accessing the central site

You can use the PPTP capabilities in Windows NT to initiate and terminate tunnels through multiple ISPs. Alternatively, you can just terminate the tunnels with an NT server and let the ISPs handle the initiation if they're set up for it.

Or you can use MobileVPN or PartnerVPN, from Aventail, to establish client-initiated tunnels via SOCKS. MobileVPN connects a single Windows or Unix client to a Unix or NT server behind the firewall at the central site. PartnerVPN connects two LANs by creating a tunnel between two Unix- or NT-based LAN servers. Aventail's VPN solutions are client/server systems. The server starts at $4995, and pricing for the client starts at $69.

Both ISPs and end users can implement PPTP VPNs using Check Point Software Technologies' FireWall-1 firewall. The company's $100 SecuRemote client software can be used to set up client-initiated PPTP tunnels, which terminate in FireWall-1 at the ISP's POP or at the corporate central site.

Ascend Communications, the dominant supplier of access switches to ISPs, has supported the protocol in its Ascend MAX WAN access switch since early 1996, allowing ISPs to offer tunneling as a service to its customers. Ascend will support L2TP when that is ready for implementation.

TimeStep offers an IPSEC encryption implementation in its Permit family of VPN products. These products include PermitPC, $99 Windows-based client software; the Security MicroGate, a $1795 box that provides VPN services for a single network node; and the $5495 Security Gateway box, which offers VPN services for an entire LAN or subnet. TimeStep also offers SNMP-based management software, the $4995 Secure Network Management System. TimeStep supports X.509 certificates and will support Internet Security Association and Key Management Protocol (ISAKMP)/Oakley when it is ready for deployment (see "Security Solutions," page 84).

AltaVista Tunnel 97, from AltaVista Internet Software (a subsidiary of Digital Equipment Corporation), is a client-initiated VPN solution. It is based on a proprietary technology, but AltaVista plans to adopt tunneling standards as they firm up. When introduced in 1995, AltaVista Tunnel required a Unix server from Digital. An NT/Intel port was released in October '96 and an NT/Alpha port in May '97. A Solaris port is expected by the end of this year. AltaVista Tunnel supports Windows 95 and NT clients. Tunnel 97 Personal Edition costs $99. The Workgroup Edition is $995.

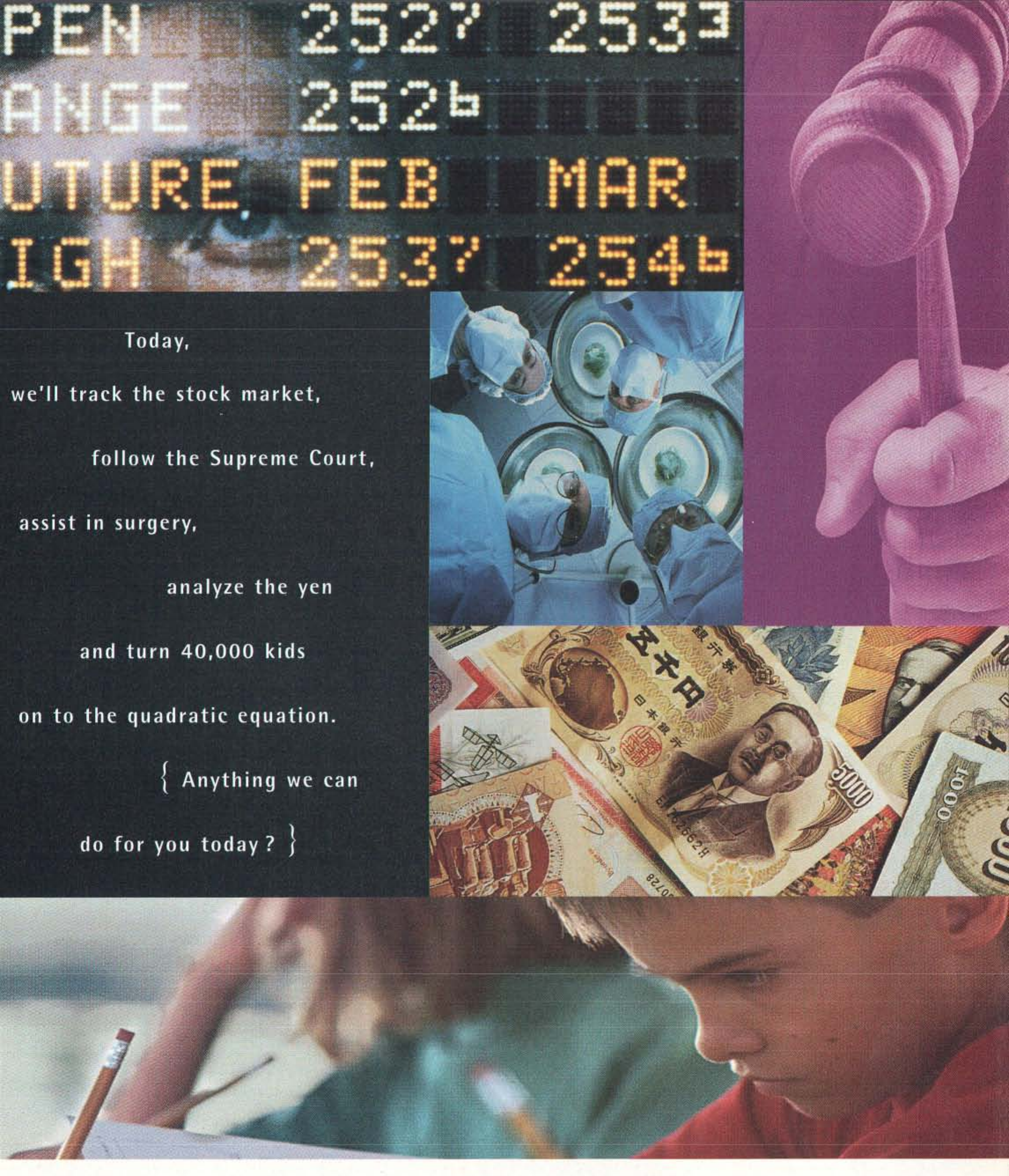
VPNet's VPLink technology allows you to set up tunnels independent of the ISP. VPLink incorporates real-time data compression along with IPSEC encryption, authentication, and key management. VPNet's $3995 VSU-1000 "VPN service unit" sits between the last router at the edge of an internal network and the outside world. The VSU-1000 manages IPSEC-based VPNs; it encrypts, decrypts, and compresses data, and it manages keys. Because the VSU-1000 offers hardware-based encryption and compression, it can saturate a T1 or E1 line. The compression mitigates the overhead of IPSEC headers, which can otherwise increase packet size to the point where the Internet fragments the packets for transmission, greatly degrading throughput over WAN links. Compression insures better performance and makes VPNet's solution more scalable.

VPNet will support tunneling approaches such as PPTP and L2TP as these standards mature and gain acceptance. The VSU-1000 can communicate with other VSUs or with the $99 VPNremote, IPSEC client software for Windows 95. A Windows NT version is slated to be released later this year. The Java-based $3995 VPNmanager tool suite configures the system. Through the use of import/export files, VPNmanager can establish intercompany extranets for companies using the VPNet products.

Finding the Balance

Pioneers began last year constructing their own VPNs. For instance, the "big three" U.S. automobile manufacturers (General Motors, Ford, and Chrysler) announced the launch of a pilot of the Automotive Network Exchange (ANX), which will allow the carmakers to exchange information and do business with their suppliers. The pilot, originally announced for late 1996, was rescheduled for Q2 1997. Production rollout is expected to begin in Q3. The ANX is sponsored by the Automotive Industry's Action Group, which consists of representatives of the big three and their tier-one suppliers. An ANX overseer company, which has not yet been selected, will provide centralized network administration and management and will certify ISPs to implement VPNs within the ANX. Bellcore is currently helping design the role of the ANX overseer. The ANX will eventually support more than 10,000 partners.

However, multiple-ISP VPNs such as the ANX may be a rarity for some time. Over the next five years, private networks will continue to carry the great majority of corporate traffic, the Gartner Group predicts. Typically, only one company will use such a private network. Fifteen percent of corporate data traffic will be carried by IP networks controlled by a single service



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provider, such as UUNet or CompuServe Network Services, according to Gartner. Multiple companies may share such a network, and the service provider can still guarantee high levels of security, availability, reliability, and performance. However, customers are limited to access via the points of presence of that service provider. Gartner predicts that only about 5 percent of corporate data traffic will traverse the public Net, which provides the most ubiquitous access but with a lower level of security and no guarantees of performance, reliability, availability, or QoS.

Rebecca Wetzel, director of Internet consulting for TeleChoice (Verona, NJ), a telecommunications consulting firm, believes those Gartner numbers may be accurate for large corporations, which invariably have a private data network infrastructure already in place. Large companies, she says, may use Internet-based VPNs mainly to support mobile workers and telecommuters, applications where ubiquitous access is key. They may not use them much for mainstream data networking applications.

In contrast, small to medium-size companies may not currently have any private data network. Internet-based VPNs, because they are so much easier and less expensive to implement, could capture the majority of this growing market over the next five years, says Wetzel.

Internet-based VPNs are not the long-awaited arrival of ubiquitous, secure, high-quality data networking that costs next to nothing. However, VPNs can provide ubiquitous data networking and networking that is better protected than most private networks from most kinds of attacks (except for denial of service and Ping of Death). VPNs can provide high-quality networking. And they can provide inexpensive networking. Finding the optimal balance between ubiquity, security, quality, and price will require consideration of a range of services and products that will only grow more varied and complex. **B**

Mike Hurwicz (**mhurwicz@attmail.com**) *is a writer and consultant based in Brooklyn, NY.*

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Double Zero

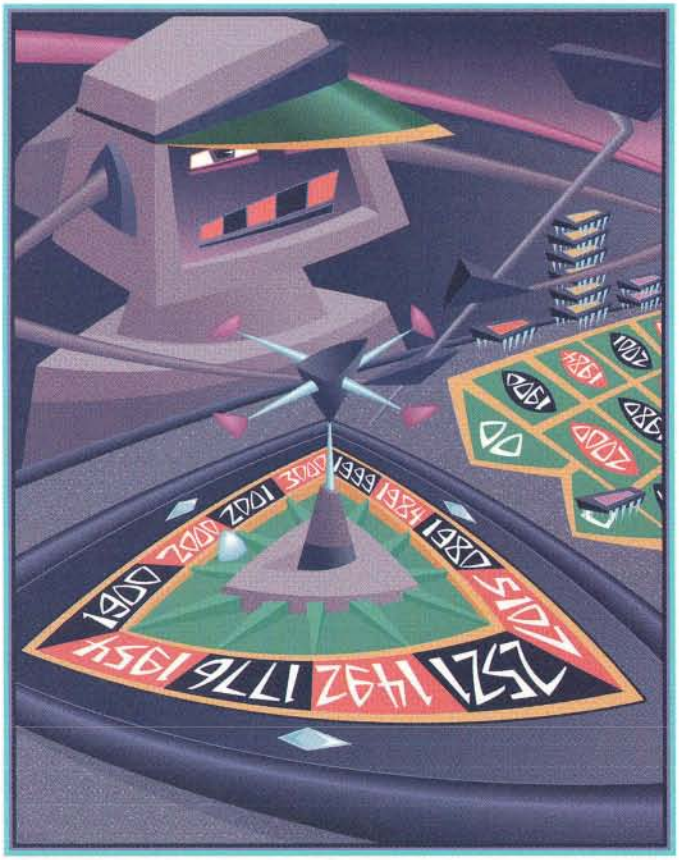
Year 2000: no COBOL, no mainframe, no problem, right? Wrong. Place your bet correctly on the year 2000 roulette wheel.

By Joe Celko and Jackie Celko

It's the end of the world as we know it. At least, as the year 2000 approaches, many people are warning of a computer apocalypse. Some of these doomsayers are software vendors and consultants who are trying to sell salvation for you and your computer system. There are several questions you will want the answer to. Should you buy? How big is the year 2000 problem, anyway? Whom will it affect? Will PC users be immune?

Well, the year 2000 problem is real, and the ramifications will be huge. No one will be completely immune, although some firms and individuals will experience fewer problems than others. Some industry experts are estimating that the worldwide cost of fixing—or surviving—the year 2000 problem will be between $400 and $600 billion.

The year 2000 problem will affect every government agency, business, or individual that uses a computer. Even if you do *not* use one, you will still feel the impact when you interact with anyone who does. If you have insurance, buy airline tickets, or want season passes to a sporting event, you may have trouble. The automated systems that control your building's heating and cooling and your cherished ATM may refuse to work.



Businesses that do not prepare properly for the year 2000 may not be able to survive it. For starters, businesses whose computer systems are not year 2000–compliant may be unable to obtain business insurance. Mistakes in calculating interest or a delay in payments, automatic checks, or premium notices may expose a company to legal risk. And nothing motivates like legal exposure.

A company may lose revenue because its computer will not recognize a purchase order with a date after 1999. A company may refuse to order from your company or refuse to enter into a joint venture with your company because your computer system cannot handle year 2000 dates in a standard way.

Even without the year 2000 problem, date-format conventions are confusing. The date "December sixteenth of the year one-thousand nine-hundred and ninety-seven" is done in many different ways. You would find it as 12/16/97 in Boston, 16/12/97 in London, 16.12.97 in Berlin, and 97-12-16 in Stockholm. Then there are conventions within industries within countries. For example, the U.S. military would write that date as 1997-Dec-16.

Software packages typically have a general way of formatting dates for display. The usual tools allow a mixture of a two- or four-digit year, a three-letter or two-digit month, and a two-digit day in the month. Slashes, dashes, or spaces separate the three fields.

ISO Dates

However, there is only *one* real international standard: ISO 8601:1988 "Data elements and interchange formats—Information interchange—Representation of dates and times." It specifies the all-numeric yyyy-mm-dd format.

The National Institute of Standards and Technology (NIST) has approved the use of slashes instead of dashes in the U.S., keeping with the older U.S. convention. (It is also interesting to note that some vendors, notably Microsoft, claim to be trying to achieve year 2000 compliance, but sell products that cannot display in the ISO 8601 date format at all.)

You can divide your potential year 2000 problems into two familiar categories: hardware and software. Of the two, software will be the most problematic.

Most of the hardware problems that happen to you will have a single universal solution. Unfortunately, however, the various combinations of packages, languages, and in-house applications that are all interacting in a single installation will make it necessary for companies to develop a unique solution for each software system.

continued

ILLUSTRATION: ROBERT BURGER © 1997

The Odometer Problem

Hardware problems occur when a system will not accept years greater than 1999. We call this the odometer problem because it is in the hardware and not in the application code. This is not the same as the millennium problem, where date representations and arithmetic are invalid. Think of the odometer in a car that has reached its upper limit and turns over to all zeros.

One example is a manufacturer of specialized fiberglass cloth who uses custom-built looms that are more than 40 years old. Each bolt of cloth is individually time-stamped by the looms. The time stamp uses a two-digit year code, and its control is by hard-wired circuit boards with transistors. This is clearly an extreme example of a hardware problem.

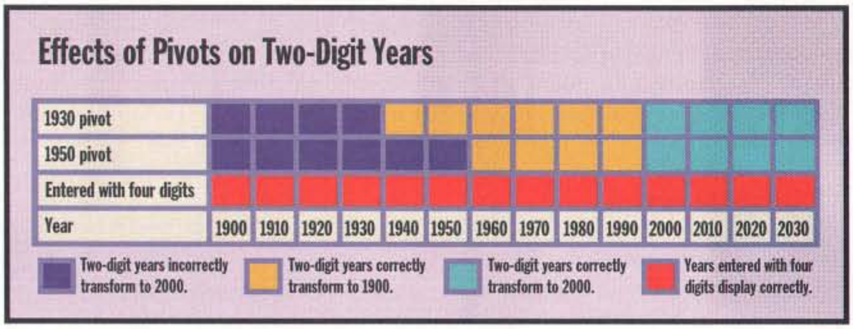
The odometer problem exists in both mainframes and PCs. For example, the Unisys 2200 system would have failed on the first day of 1996 because the eighth bit of the year field—a signed integer—went to one. The vendor was able to solve this problem.

Other internal date representations have different failure dates, but many of them fall in the first century of the next millennium. Mainframe vendors are working on solutions that will let their hardware continue to function into the twenty-first century. However, users with very old equipment—such as the manufacturer with those looms—may be on their own if the vendor refuses or is unable to support the equipment.

Intel-based PCs also have odometer problems. How the system clock will wrap around depends on your BIOS chip, but the most common dates to which it will reset are 1900, 1980, and 1984. You can test your computer. Set the date and time to 1999-12-31 (in whatever input format your machine expects) at 23:59:51. Let the machine run 10 seconds so that the clock rolls over. What happens next depends on your BIOS chip and DOS version.

The result may be a date display that shows 01/01/00, so you think you have no problems. Although the *display* may appear to be correct, the clock may read 1980-01-01 or 1900-01-01 internally. You may find newly created files with dates in the twentieth century, because the OS accessed the clock directly and fetched the incorrect date.

This problem passes along to applications, but not always in the way you would think. Quicken 3 for the PC running on DOS 6 is one example. As you expect, directly inputting the date 2000-01-01 results in the year resetting to 1980 or 1984 off the system clock. Strangely enough, however, letting it wrap from 1999-12-31 into the year 2000, Quicken interpreted the change as 1901-01-01 and not as 1900. This indicates that Quicken sometimes references the internal clock and sometimes uses a date the user inputs. The date referenced from the clock and the date input manually into the system are both incorrect and different.



Effects of Pivots on Two-Digit Years

Year	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010	2020	2030
1930 pivot	🟪	🟪	🟪	🟪	🟧	🟧	🟧	🟧	🟧	🟧	🟦	🟦	🟦	🟦
1950 pivot	🟪	🟪	🟪	🟪	🟪	🟪	🟧	🟧	🟧	🟧	🟦	🟦	🟦	🟦
Entered with four digits	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥

🟪 Two-digit years incorrectly transform to 2000.
🟧 Two-digit years correctly transform to 1900.
🟦 Two-digit years correctly transform to 2000.
🟥 Years entered with four digits display correctly.

Using a simple pivot point makes some 1900-years correct, but it may turn 1900-years into 2000-years.

A number of widely available freeware programs do year 2000 tests on PCs. These include DOSCHK from Bob Stammers, 2000Test and 2000Fix from Dan Goodell, and Year2000 from Tom Becker (Air System Technologies).

Other PC applications known to exhibit year 2000 difficulties include Microsoft Access, FoxPro, and Visual Basic; CA Clipper; Borland Delphi; Gupta SQLbase; and Oracle. Fixes or workarounds for many of them are widely available as freeware.

Because the year 2000 is two-and-a-half years away and the life span of a PC in some environments is shorter, some managers believe the problem is self-limiting. There are, however, many older machines out there. What usually happens to old machines in a corporate environment is that they stay in service but pass down the line to a less-critical function as newer models replace them.

Another solution is to replace the chip. This is expensive and time-consuming when you have a large number of machines. A software patch may not be enough if a program reads the clock for itself or if the patch does not work with existing programs.

Some vendors are ensuring that machines made after a certain date are problem-free. These vendors include AST Computer, for machines that were made after July 1996.

Some generic Pentium-processor machines have their BIOS in a flash EPROM that you can directly upgrade. If you have a BIOS chip from Award or AMI manufactured later than October 1995, you may be able to upgrade it using a patch from the manufacturer's Web site.

Some earlier machines are also upgradable, so check your documentation. Many other manufacturers are supplying or will soon supply user-upgradable systems. Again, check the documentation. No manufacturer will guarantee that the patches will fix all hardware-related date problems, but as the year 2000 approaches, manufacturers will continue to offer improved patches.

Many motherboards allow user upgrades, but sometimes you must perform the upgrade in the proper sequence. Some motherboards have a jumper switch that you must set before upgrading the system. If you do not follow the proper procedure, the system will return an error message. Even worse, the upgrade will appear to have worked but will actually have done nothing.

Planning Your Campaign

David Eddy of Global Software states, "While about 99 percent of what's been publicly written about Y2K so far is essentially 'Y2K is a COBOL mainframe problem,' this absolutely is *not* the case. Software is software. To the best of my knowledge, there is no language (even the Department of Defense's Ada) that forces the features and capabilities of that language to actually be used correctly."

Software problems caused by the year

2000 will be widespread, complex, and costly to repair. According to Capers Jones of the Software Productivity Consortium, the cost to get your software ready for the year 2000 will vary by language and industry. For example, programs written in COBOL will cost about $28 per function point. Programs written in assembly language will cost more than $75 per function point, and programs written in object-oriented languages will cost less than $18 per function point.

Old legacy systems written in-house will be the most costly to repair. In many cases, the source code and even the specifications may no longer exist. Upgrades and problem fixes may have no documentation. Old packages may no longer have support, even if the original vendor is still in business.

Some new packages that claim to be year 2000–ready will still fail under the right combination of factors. That includes software written for PCs. Spreadsheets are the worst offenders, depending on how internal date-handling functions work, but any package that uses a calendar or scheduling function is at risk, including databases. When these packages feed data to a network computer, the contaminated data passes along to your entire system.

The Process

The general steps necessary for a year 2000 project are:

1. Allocate adequate resources. The project will require a full-time manager. Be aware that the preparation-and-testing phase will take months.

2. Choose products and consultants that *do not* offer a one-size-fits-all approach. You will probably need several tools.

3. Analyze and test hardware, programs, and database files.

4. Eliminate dead and redundant code.

5. Use a simple pivot-point approach on applications that have a short time horizon and do not interact with other programs. A library checkout system is an example. Pivot-point approaches may also be appropriate for systems that are becoming obsolete and that cannot justify the expense of a full conversion.

6. Fix or replace remaining problems with date routines.

7. Retest.

Even bringing your own system into perfect compliance may not be enough if you interact with other systems and bring contaminated data back into your own system. Lack of standardization of date formats coupled with what year 2000 compliance entails will continue to be a problem.

Your Options

There are four methods for dealing with the year 2000:

1. Do nothing. Wait to see what blows up and fix it when it does. This is the choice of a surprising number of small- and medium-size firms. This ostrich approach may be attractive—especially if you plan to retire by the year 2000—but remember: You will be counting on the company computer to do your retirement benefits correctly.
2. Replace everything. Small firms can frequently afford to replace their software because they do not have large historical databases. If they choose not to replace their application programs, they can frequently upgrade them and get a fix from the vendor.
3. Do simple fixes. Many products offer a simple fix for existing software. You may not have to change the data or may have to make only small changes.
4. Do a full analysis and complete fix. This involves testing and analyzing the system for potential date problems and making changes to the system so that it will handle the year 2000 correctly. The system must change internally to handle a four-digit year and change at the point of input so users must input a four-digit year.

The simple fix usually involves a *pivot point* (see the figure "Effects of Pivots on Two-Digit Years" on page 90). This approach, which is also called a time frame or epoch setting, lets you patch applications without changing the data by making an assumption about the century in which a two-digit year falls. Using a particular year as a pivot point, the system adds either 1900 or 2000 to the two-digit year to make it a four-digit year. For example, if the program is looking at PC software, it's safe to assume that 70 and above belongs in the 1900s, so 70 would be the pivot point. If the program is looking at

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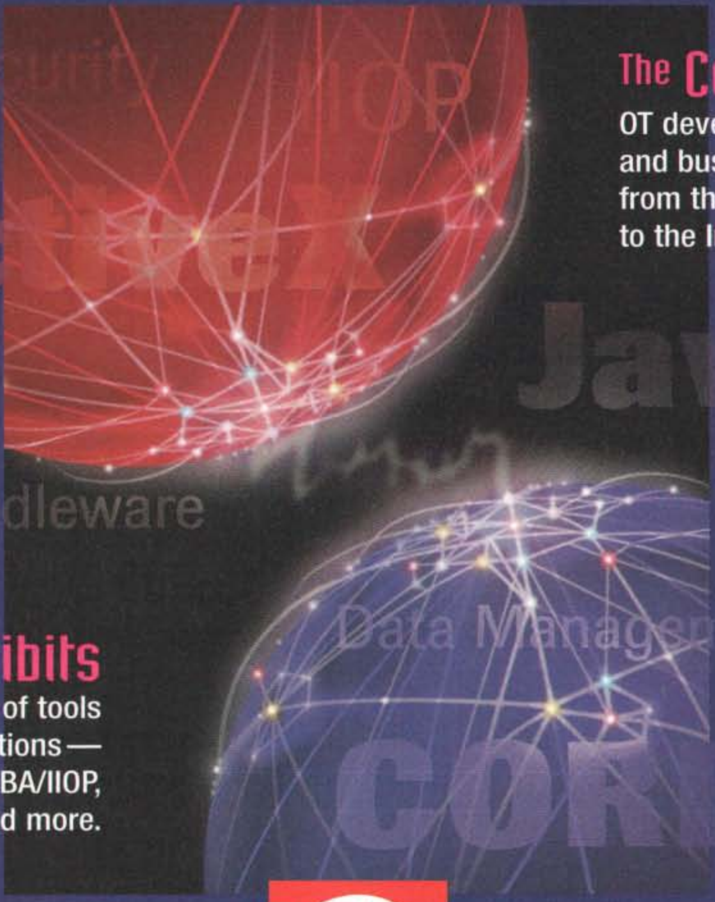

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kindergarten-age children, a pivot point of 90 might be appropriate (although you might turn up some centenarians in the process).

This is not a new idea. Look at printed forms such as personal checks. Many forms have the date space preprinted as ________19__, under the assumption that the century is the twentieth.

Many packages use a pivot point in a variety of price ranges for the most popular languages and platforms. There are advantages to using a package that relies on a pivot point to handle your year 2000 problem. It is less expensive than a full analysis and repair of the system, and it requires less user training and involvement. In many cases, the end user continues to key two-digit dates and all the work happens behind the scenes.

A disadvantage of this method is that you must pick a pivot point between 00 and 99, and there is no reason to favor one pivot point over any other. If Microsoft's lead becomes a de facto standard, the two-digit years between 00 and 29 will convert to 2000 to 2029, while 30 to 99 will convert to 1930 to 1999. This makes the birthday of a person born in 1920 wrong. Quicken maps the two-digit years 00 to 50 into the years 2000 to 2050. This makes calculating the return on a stock you bought in 1949 wrong. In short, there may be no perfect universal pivot point for a given application.

Within this class of solutions, you can store the dates as either four digits or two digits. Storing them as four digits means you are using the two-digit year format as a convenience for data-entry clerks or users. If you do this, you should display the full date in the proper format for all reports.

If you keep the year as two digits internally, you will have problems. When two of your own applications disagree on the pivot point, in effect, every date has its own user-defined data type. You will need to write conversion routines to use both types of dates in the same calculations. If you do not have control over both programs because one of them is external to your system, you risk internal calculation errors that will be difficult to detect. If only a tiny percentage of the dates used to calculate interest rates are incorrect, the incorrect dates will be difficult to identify—but the calculation errors could have an enormous impact.

Only a small part of your system will lend itself to this type of fix. This is a quick-and-useful patch, but it's only for systems with short time horizons or that are due for replacement soon.

Big System, Big Changes

You must analyze medium to large systems as a whole and make repairs to bring them into year 2000 compliance. For many firms, the year 2000 effort will be their largest data-processing project ever.

When Data Integrity ran a test of 1,000,000 lines of COBOL produced by a variety of industries, it discovered that less than 13 percent of the COBOL modules were affected and that less than 0.5 percent of the total code had to be changed (see the figure "Finding the Needles in the Haystack" on page 95). This test indicates that a good front-end analysis to locate problem areas and assess their impact is essential. COBOL-oriented analysis products include Adapt/2000, from Allegiant Legacy Solutions.

The analysis phase of the project may take up to a year. A lengthy up-front analysis clearly can save you time and money over the life of the project. Anne White, marketing manager of Isogon, believes that a big part of the project is to identify and eliminate dead code. Frequently, 20 percent to 30 percent of the code in large mainframe systems is no longer used.

An analysis of a Texas oil company indicated that 40 percent of its code was dead and could be deleted. Isogon calculates the cost of bringing a system into year 2000 compliance to be about $1.50 per line of code. By eliminating 40 percent of its code, the company saved 40 percent of the conversion cost.

As you go through the steps to identify dead code, products such as Isogon's Audit 2000 will also help you identify your most mission-critical, active code, so you can begin working on the necessary changes. Graham Thompson of Global Software stresses that you cannot analyze one program in isolation from the system. The program that collects the data may be quite distant from the program that uses the data. It is important to look at JCL and utility programs for sorting parameters and follow the data through the system as well as within individual programs.

Fifty percent of your project's budget may be for testing. Some shops have adopted the approach of using the initial test data to retest the system, but much of the test data and many scenarios were

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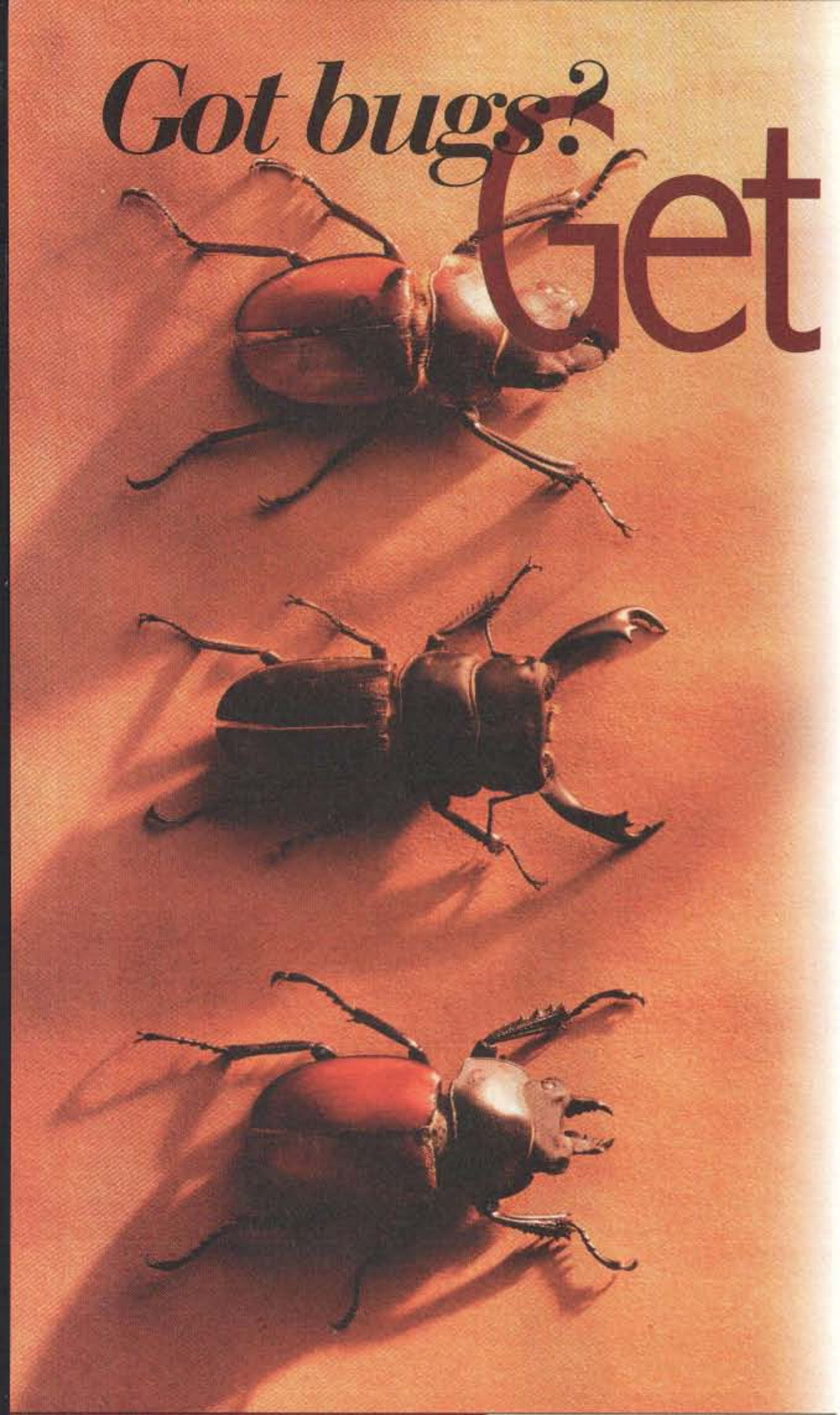

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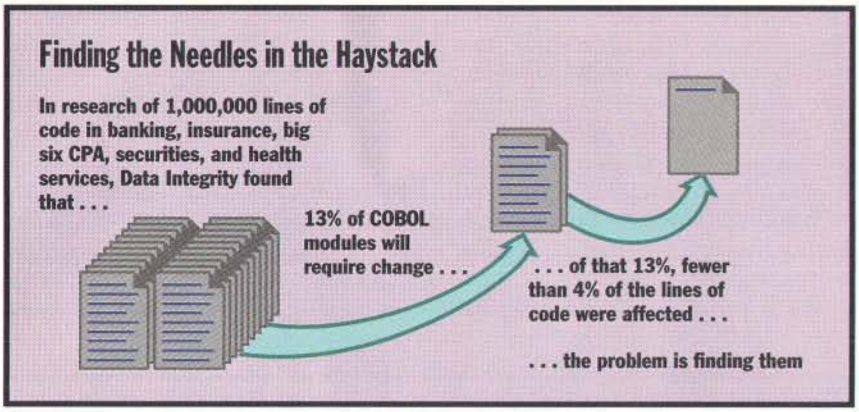
Finding the Needles in the Haystack
In research of 1,000,000 lines of code in banking, insurance, big six CPA, securities, and health services, Data Integrity found that . . .
13% of COBOL modules will require change . . .
. . . of that 13%, fewer than 4% of the lines of code were affected . . .
. . . the problem is finding them

Studies show that not much COBOL code needs to change—but it does need to change, and you have to find it first.

developed before the year 2000 was a serious consideration. QES/EZ, from QES Software, lets end users develop models and use them to identify problem areas caused by the year 2000. After you fix the problem, the same model can retest the system. The system does not need to be shut down during testing. The product is PC-based and operates independent of language or OS.

Weird Dates

It is important to begin your year 2000 project as soon as possible. In a large firm, the project may take longer than a year. While some experts are saying that you must complete the project by June 1, 1999—the start of the 1999–2000 fiscal year—in reality, for many firms, the actual date is January 1, 1999. This is because many programs, particularly those developed in-house, use the number 99 to indicate indefinite or unknown information. That's only one example of a "weird date."

Some common problems that you can expect to encounter as you analyze your system will be the result of such weird dates. Weird dates are a result of programming languages not having a date data type built into them. This forced applications developers to write their own date routines. Besides letting developers use the year-in-the-century format and create all the problems associated with it, it also let them permit temporal data values that are not really dates in these fields.

There are two basic species of weird dates, with many subspecies. For lack of better names, I'll call them dates that are not dates and nondates that are really dates until we can get better names.

Dates that are not dates: The most common examples are *eternity codes*, which come in two basic flavors in old COBOL systems using character fields. The indefinite future was shown as 9999-99-99 or 99-99-99. It meant that the event had not yet happened or might never happen. Likewise, the indefinite past was shown as 0000-00-00 or 00-00-00. It meant that the event had already happened, but we did not know the exact date. For example, you do not know an employee's retirement date, so you use the indefinite future code. You do not know an employee's birth date, so you use the indefinite past code.

The major advantage of these encoding schemes is that these values will sort together either before or after all valid date representations. They also save space in the files, which was a consideration in the old days.

This method was never standardized, and the encoding scheme tended to grow as more codes were added. For example, one state prison system used all 9s and all 8s for life sentence and death sentence, respectively, in the "expected date of release" field that's found in inmate records. Commercial users also found that expiration dates for lifetime warranties could be encoded this way and then broken down into types of warranty—parts and labor, parts only, labor only, and so forth.

Automatic conversion tools that are trying to move the legacy data to SQL databases cannot handle this type of encoding well. They either put the records in a rejection file or convert all the special codes to NULLs. The proper way to handle this

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would involve creating a second column in the table to hold a separate code for the reason the date is missing.

Not all eternity codes are deliberate. When you build a data warehouse and have to scrub your data, you will find that data-entry clerks, who ran into situations where they needed an indefinite past or future value in a column, invented their own codes. If the field edits were not rigorous, virtually anything could get into the database.

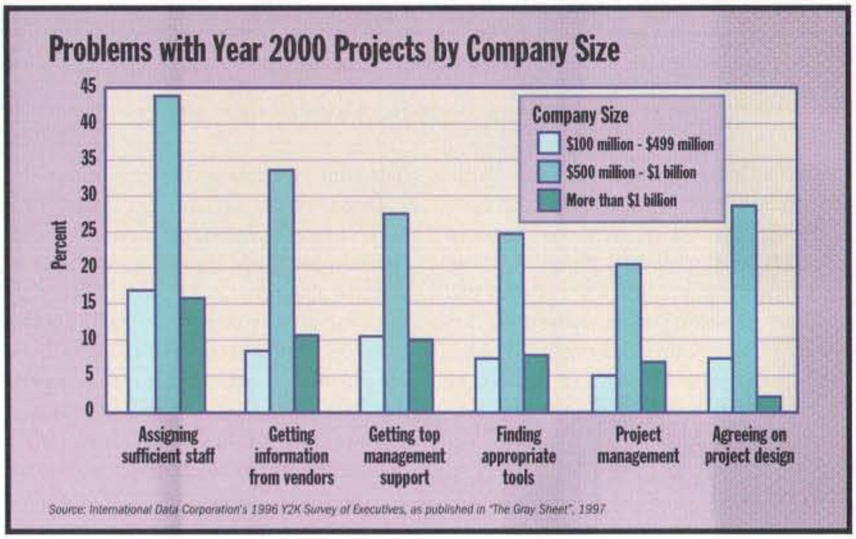
An interesting example found in legacy data is 1111-11-11, which is a valid date that you can key into a form screen or punch-card field by holding the 1 key down and letting it repeat. Blanks and repeated letters (xxxx-xx-xx) were also another popular option when field format editing was poor.

Nondates that are really dates: The other subspecies of weird dates includes fields that are not dates per se, but that derive from or contain dates. Some common examples are account and serial numbers that begin with the year in the century. For example, the first account number issued by such an application in 1997 might be 97-0001, the second would be 97-0002, and so forth. This is a common numbering pattern in the insurance industry.

As in the case of the first subspecies of weird dates, multiple facts have overloaded the field, and the data is not normalized. Programmers who knew the numbering pattern wrote code based on the implicit ordering between the serial number and the sequence in which they occurred. If the pattern continues and the first account created in the year 2000 is 00-0001, all those programs are going to fail.

The most common and dangerous example of this problem is the IBM magnetic-tape label convention. For decades, tape librarian systems automatically assigned a label to the reels of magnetic tape made up of the year in the century and the day in the year (001 through 366). This label number determines which "expired" tapes to recycle, destroy, or erase. Note that tape label 00-001 is lower than tape label 99-365 and therefore subject to earlier destruction.

More subtle forms of this category of problems exist in algorithms that use parts of the system clock or other dates as parameters to produce a result that is not so obviously date-related.



Source: International Data Corporation's 1996 Y2K Survey of Executives, as published in "The Gray Sheet", 1997

Midsize companies report the most problems with every aspect of year 2000 projects.

Leap Year

You might remember being told in grade school that there are 365.25 days per year and that the accumulation of the quarter day creates a leap year every four years. There are really 365.2422 days per year, and every 400 years, the fraction of the fractional day left over from the "regular" leap years accumulates, too.

Yes, as if matters aren't complicated enough, 2000 is a leap year. Since most people are not over 400 years old, we have not seen this rule applied until now. Certainly, no computers have. The correct test for leap years in Pascal is the following:

```
FUNCTION isleapyear (year:
INTEGER): BOOLEAN;
BEGIN
IF ((year MOD 400) = 0)
THEN isleapyear := TRUE
ELSE IF ((year MOD 100) = 0)
  THEN isleapyear := FALSE
  ELSE IF ((year MOD 4) = 0)
    THEN isleapyear := TRUE
    ELSE isleapyear := FALSE;
END;
```

Many programs do not use this algorithm. They implement only incomplete versions of it. One such fiasco was the failure of Wacovia Bank to post automatic payroll deposits on 1996-02-29, because its program did not even get as far as doing the "division by four" test.

The problem is not just in legacy applications that are written in-house. Many packaged programs are also flawed. The date functions in spreadsheets seem to be the worst offenders, but any program with a date function in it may be wrong. Just key in the date 2000-02-29, do some calculations with date arithmetic, and see what happens.

The year 2000 is coming in less than three years. If you have not started your testing-and-conversion project, the time is now. Many large mainframe vendors such as IBM have year 2000 initiatives and are working to help their customers prepare. The number of consultants working in the area is increasing, and the number of products being offered by vendors is spiraling upward. Time is the resource that is most lacking.

The year 2000 problem originated, of course, with hardware and software designers who did not foresee the turn of the century and plan for it. This lack of foresight became immortal in computers and programs that may go haywire when the calendar flips over from 1999 to 2000. Will today's designers learn from this experience? See you in 2100.

Joe Celko is an Atlanta-based consultant with Northern Lights Software, Ltd. He has been a member of the ANSI X3H2 Database Standards Committee since 1987 and helped write the ANSI/ISO SQL-89 and SQL-92 standards. He is the author of four SQL books. You can reach him at **71062.1056@compuserve.com**. *Jackie Celko is an Atlanta-based technical writer.*

Jon Udell

Web Project

Textbase Tricks

It's easy to collect piles of textual data using the Web. How can you organize and present this stuff in useful ways? Here are some tips.

Last October's column, "Web Surveys" (http://www.byte.com/art/9610/sec10/art1.htm), featured a Perl script, form2db.pl, that reads an HTML form and writes several new scripts. One of these scripts stores the form's data in a structured-text format; another loads that text data into a SQL database.

Why not just eliminate the middleman and pump the data straight into the database? The kinds of data that I tend to collect using the Web fall into two categories: structured and semistructured. These data types require different tools and techniques.

For instance, if the question is "What percentage of European respondents uses ISDN both at work and at home?," then a SQL query will give you the answer. But if the question is "What do respondents say about the experience of buying and installing ISDN equipment?," then there's no quantifiable answer. You just need to turn a bunch of anecdotal information (i.e., text) into a navigable and searchable archive (i.e., a textbase) that you can conveniently review.

Last October's column left this part of the process as an exercise for the reader. It's now time to fill in the blanks.

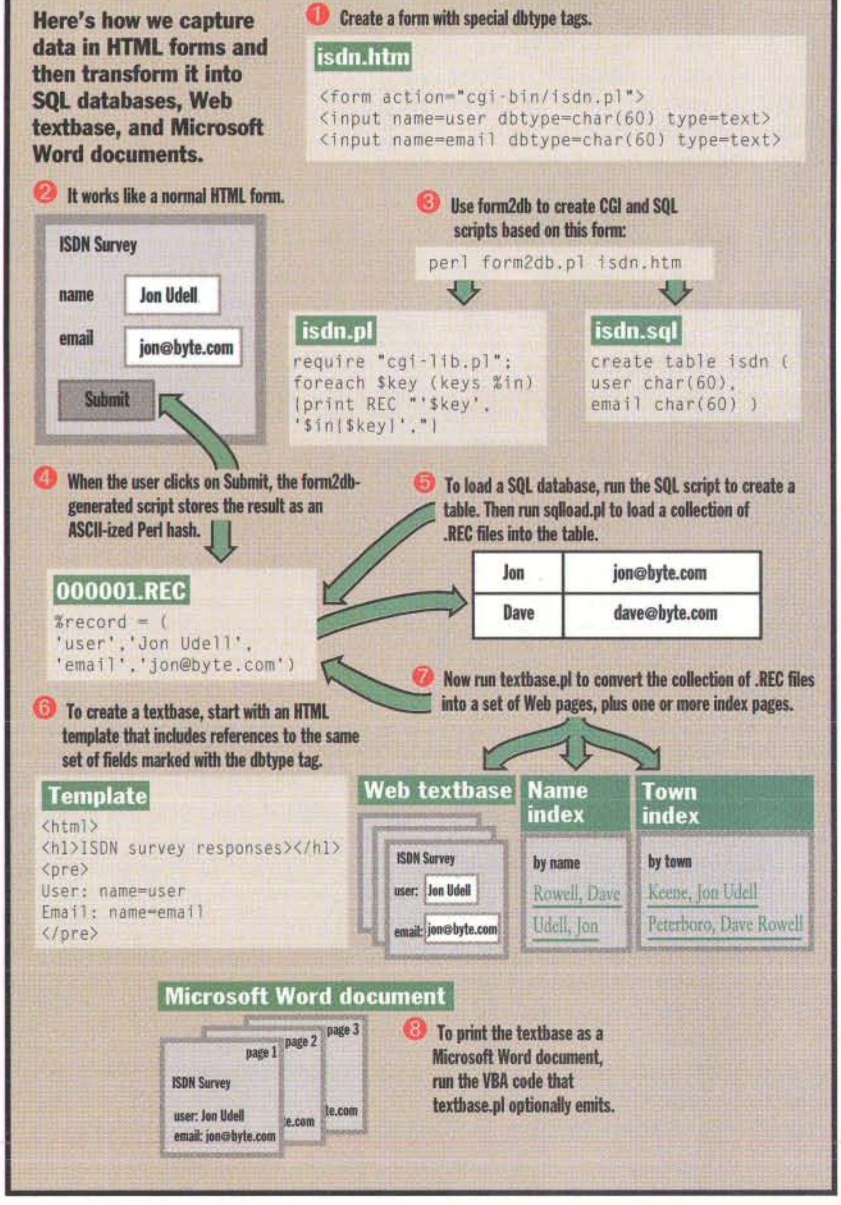
Form2db Revisited

I continue to get a good deal of mileage out of this handy script. To recap briefly, form2db reads slightly modified HTML forms. If the normal coding for a text-input field is

```
<input name=email type=text
  size=60>
```

then the modified version will look like this:

Managing Text Data with Form2db.pl and Textbase.pl



Here's how we capture data in HTML forms and then transform it into SQL databases, Web textbase, and Microsoft Word documents.

① Create a form with special dbtype tags.

isdn.htm

```
<form action="cgi-bin/isdn.pl">
<input name=user dbtype=char(60) type=text>
<input name=email dbtype=char(60) type=text>
```

② It works like a normal HTML form.

③ Use form2db to create CGI and SQL scripts based on this form:

```
perl form2db.pl isdn.htm
```

isdn.pl

```
require "cgi-lib.pl";
foreach $key (keys %in)
{print REC "'$key'.
'$in{$key}'."}
```

isdn.sql

```
create table isdn (
user char(60),
email char(60) )
```

④ When the user clicks on Submit, the form2db-generated script stores the result as an ASCII-ized Perl hash.

000001.REC

```
%record = (
'user','Jon Udell',
'email','jon@byte.com')
```

⑤ To load a SQL database, run the SQL script to create a table. Then run sqlload.pl to load a collection of .REC files into the table.

Jon	jon@byte.com
Dave	dave@byte.com

⑥ To create a textbase, start with an HTML template that includes references to the same set of fields marked with the dbtype tag.

Template

```
<html>
<h1>ISDN survey responses></h1>
<pre>
User: name=user
Email: name=email
</pre>
```

⑦ Now run textbase.pl to convert the collection of .REC files into a set of Web pages, plus one or more index pages.

⑧ To print the textbase as a Microsoft Word document, run the VBA code that textbase.pl optionally emits.

PHOTOGRAPH: KELLIE WALSH © 1997

```
<input name=email type=text
  dbtype=char(60)>
```

These fake `dbtype` tags serve two purposes. First, they tell form2db to add processing code for this field to the CGI script that it creates. (This is the script that receives the form's data when you click on Submit and that stores the data to a structured text file.) Second, these tags tell form2db to add a data definition statement to the SQL script that it creates. (This is the script you run to create the database table that will store the form's structured data.)

HTML forms refer to the scripts that process them in this way:

```
<form action="/cgi-bin/isdn.pl">
```

The form2db script uses the name of the script in three ways: 1) To write the actual file isdn.pl, which contains the form's handler; 2) To instruct isdn.pl to store records in a subdirectory called isdn; and 3) To instruct isdn.sql to create a SQL table called isdn.

In the isdn subdirectory, isdn.pl stores a series of files with names like 000001.REC. Inside each of these files is an ASCII-ized representation of a Perl associative array (aka hash, Smalltalk dictionary, or Java hashtable). Here's an example:

```
%record = (
'name','Jon Udell',
'email','jon_u@dev5.byte.com',
'uses_isdn','no')
```

Text in this format has an interesting property: It's also Perl code. If in a subsequent Perl script you evaluate the expression

```
do '000001.REC';
```

then the result will be an in-memory hash, called `%record`, containing the keys and values shown above. From there, you can go in either direction—it's easy to process a collection of these hashes into a SQL database, or into a textbase, or both.

There's a crucial security issue lurking under the surface here. You've got to make sure that the values of the hash—what users type into the fields of your form—will not be evaluated as Perl expressions. I got this wrong initially, and I was very grateful that alert reader Dov Grobgeld pointed out my error (see the text box "A Subtle Perl Security Pitfall" above).

A Subtle Perl Security Pitfall

The code shown on page 134 of the October 1996 BYTE contains a security hole. Below is the explanation, in the words of alert reader Dov Grobgeld.

In your code, you make "a text representation of a Perl associative array" with a code segment that looks something like this:

```
foreach $f (keys %record) {
  s/\"/\\"/g;
  print RECORD
"'".$f."\',\"".$in{$f}."\",\n";
  }
```

Later on you do this statement:

```
do '0001.REC';
```

What you actually do here is execute unknown code! You have no idea what's inside the `%record` strings or how they might interact with the intricate syntax of Perl. The only thing you take care of is to escape the ' " ' character, but that's not enough.

Time for an example of something that may be nasty. Let's say you have a text field called email created through

```
<input type="text" name="email">
```

And someone inputs the following "email" address:

```
@_['mail jon_u\@dev5.byte.com <
  /etc/passwd']
```

This will create a file called 0001.REC, which looks like this:

```
%record=('email', "@_['mail jon_u\
  @dev5.byte.com </etc/passwd']");
```

[Editor's note: For Perl noninitiates, @_ is Perl's built-in array of arguments. The square brackets form an index into that array. In Perl, any expression that appears within square brackets will be evaluated to yield an array index. Here, the entire construct is meaningless, except for its very nasty side effect.]

When you run that code through `perl5`, you will receive a copy of `/etc/passwd` in your mail.

Dov was right! For reasons that escape me, I had wrapped double rather than single quotes around the hash value. This invites Perl to evaluate the expression, with possibly disastrous results.

I've now switched to single-quoting the user input, as I should have done all along. This method should ensure that the input will not be evaluated, but will instead be handled as literal text.

However, as Dov's message shows, Perl can be as dangerous as it is powerful. I advise caution. Note, for example, that the hole Dov found does not exist at the time the form data is stored, but rather at the time it's loaded for use. This process need not occur—and perhaps should not occur—on a production Internet-connected server.

Building the Textbase

So, how can you transform those hunks of Perl code into a textbase? I wrote the textbase.pl program to perform this job. You point it at a collection of .REC files and an HTML template. As is true of the form that kicks off this whole process, the template can be as plain or as fancy as you like. You can create it with either a text editor or a WYSIWYG HTML editor. What links the template to the data? Wherever you want a field to appear, you insert a placeholder like this:

```
name="email"
```

When you run textbase.pl, it first absorbs the template and then (like a mail-merge program) runs through each of the .REC files in turn, substituting values for the placeholder. Thus, 000001.REC becomes 000001.HTM, a Web page that reflects whatever styling you've applied to the template.

What if you want a new style? Just alter the template. The next time that textbase.pl runs, it upgrades the entire set of Web pages to the new style. When does textbase.pl run? That depends on how "hot" your users require the textbase to be. Some applications require nothing more than a scheduled daily update. Others require near-real-time feedback, in which case I spawn textbase.pl in a background process whenever somebody submits a new record.

This approach can't really be called dynamic HTML. Nor is it static. It's really a hybrid of those two methods, with some of the advantages of each. Because a process dynamically regenerates the textbase, you can propagate style changes uniformly across the data set. Because users fetch static pages, there's none of the run-time

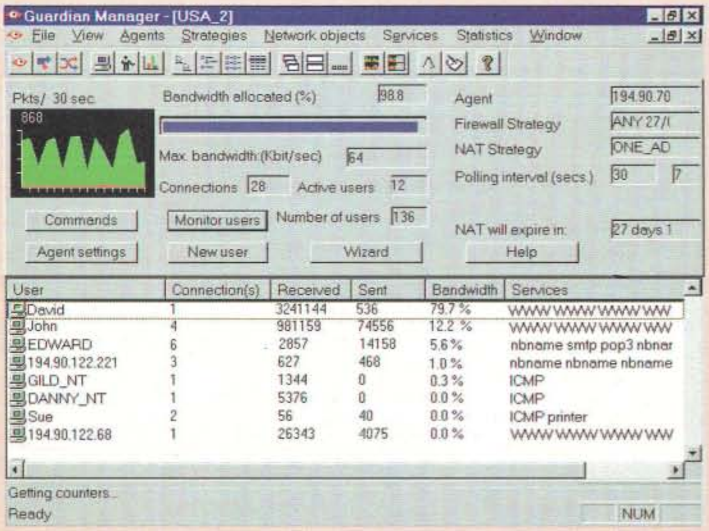
FIREWALL FOCUS

NetGuard's Guardian moves data at rates above real-world maximum

Guardian has emerged as the top performing firewall operating on a standard Windows NT system and Pentium platform, according to the NSTL lab test results for firewall products. NetGuards' Guardian moved data at rates above the real-world maximum. In fact, Guardian's throughput was more than twice that of the other standard NT vendors.

Guardian's inspection of all packets at the MAC layer reduces the high overhead of packet handling in the higher protocol layers. MAC layer inspection also provides an extremely important security advantage by blocking hacker's attacks on the firewall's operating system and TCP/IP layers, where most firewall penetration occurs.

Security testing plays a large role in the examination of firewall products and Guardian's MAC layer stateful inspection placed it among the best. Guardian passed the NSTL security tests with impressive results. In some security scenarios Guardian was among the only entries that provided the maximum protection.


Guardian Manager - [USA_2]
File View Agents Strategies Network objects Services Statistics Window
Pkts/ 30 sec
868
Commands
Monitor users
Agent settings
New user
Wizard
Help

Bandwidth allocated (%) 98.8
Max. bandwidth:(Kbit/sec) 64
Connections 28 Active users 12
Number of users 136
Agent 194.90.70
Firewall Strategy ANY 27/(
NAT Strategy ONE_AD
Polling interval (secs.) 30 7
NAT will expire in: 27 days 1

User	Connection(s)	Received	Sent	Bandwidth	Services
David	1	3241144	536	79.7 %	WWW WWW WWW WW
John	4	981159	74556	12.2 %	WWW WWW WWW WW
EDWARD	6	2857	14158	5.6 %	nbname smtp pop3 nbnar
194.90.122.221	3	627	468	1.0 %	nbname nbname nbname
GILD_NT	1	1344	0	0.3 %	ICMP
DANNY_NT	1	5376	0	0.0 %	ICMP
Sue	2	56	40	0.0 %	ICMP printer
194.90.122.68	1	26343	4075	0.0 %	WWW WWW WWW WW

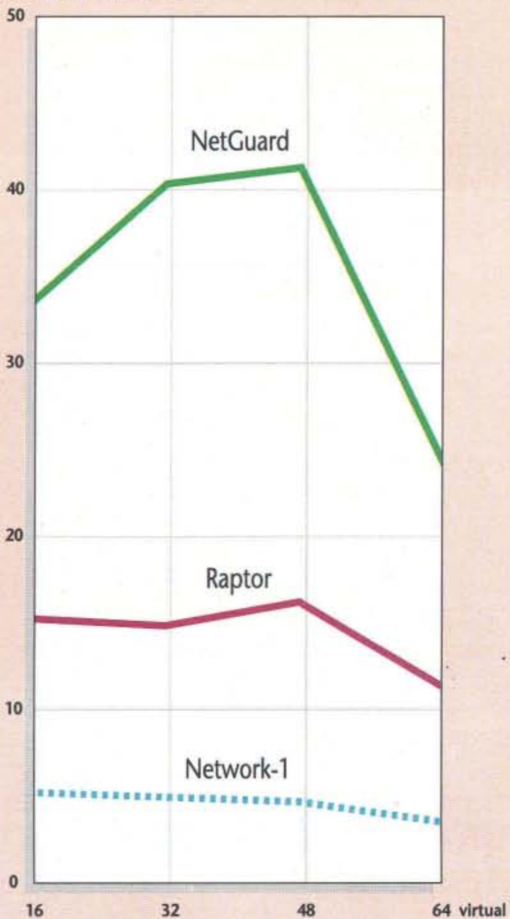
Getting counters...
Ready
NUM

Guardian however, is not simply a firewall preventing penetration to local networks from the external Internet. Guardian provides a vital function in bandwidth control as well as providing tools to control users' productivity through access restrictions, monitoring capabilities and activity reports.

The *Guardian Manager* monitors every piece of information to and from the outside world, and creates a database which supplies comprehensive information on users' connections. The Guardian generates reports on bandwidth consumption, users' total connection time, total data sent or received, and destination hosts' addresses. Reports can be viewed on screen, printed or exported to Excel or Access for further processing. These powerful new tools add to the overall excellence of the Guardian management and security solution.

Guardian is available for free evaluation by download or request for free CD-ROM from NetGuard's Website: http://www.ntguard.com

NSTL Windows NT Firewall Performance



Graph shows NSTL March '97 Test Results for Standard Windows NT Firewalls tested

GUARDIAN

Productive Security

Internet Product of the Year

NetGuard

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2445 Midway Road
Building 2
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75006 USA
Tel: 1-972-738-6900
Fax: 1-972-738-6999

LanOptics (UK) Ltd.
Thamesbourne Lodge,
Station Road, Bourne End,
Buckinghamshire SL8 5QH
United Kingdom
Tel: +44-1628-533-433
Fax: +44-1628-523-252

NetGuard Ltd.
LanOptics Building
Ramat Gabriel Industrial Park,
P.O.Box 184
Migdal Ha-Emek 10551, Israel
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Fax: +972-6-654-0124

Free Evaluation Download
http://www.ntguard.com

Circle 202 on Inquiry Card.

overhead or complexity that comes with on-demand page generation.

Note that the template can act like a filter. You don't need to include all the fields from the form in the template. In fact, I typically send one subset of the form's fields over to a SQL database for relational analysis, and another subset to a textbase for interactive review.

Indexing the Textbase

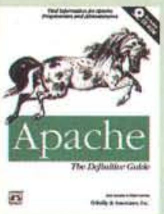
Now you've got a pile of .HTM files, one per record. How to present them? Textbase.pl will also generate one or more index pages. For the ISDN survey, let's say you want to index by name and by country. A piece of the name index might look like this:

```
<br><a href="000002.htm">
   Germany......Mauth, Rainer</a>
<br><a href="000001.htm">
   US..........Udell, Jon</a>
```

As it processes records, textbase.pl builds a hash for each index you require. The keys of each index hash are just strings that begin with the primary key for that index (say, country), and then pad to some fixed width, and then tack on whatever other fields should appear on that index page. The values of each index hash are the generated HTML filenames. After running through all the records, textbase.pl sorts the keys of the index hashes (a trivial operation in Perl) and then emits lines of HTML, as shown earlier.

BOOKNOTE

Apache: The Definitive Guide



$34.95
by Ben Laurie and Peter Laurie
ISBN 1-56592-250-6
http://www.ora.com/

Apache, running on BYTE's Linux server, handles the Web half of our conferencing system. Although Apache is in fact the world's most popular Web server, its documentation has been spotty. No longer, thanks to this excellent guide.

TOOLWATCH

RegClean

http://www.microsoft.com/kb/softlib/mslfiles/RegCln41.exe

This free utility claims to sweep the junk out of your Windows registry. Does it work? I can't really tell, but people do swear by it. If you've got Windows into a weird state, it's worth a try.

This is data management at its most primal. Where is the database? There isn't one. Databases are great; don't get me wrong. But they can be overkill for simple applications that just need to collect and present a few thousand records. And when those records are text-heavy, conventional databases often aren't the best tool for the job.

Printing the Textbase

The May column's Toolwatch featured Canon's WebRecord, one answer to the surprisingly thorny problem of printing a collection of Web pages. In textbase.pl I provide another kind of answer. I decided that I would like to able to turn a Web textbase into a Microsoft Word document, complete with page numbers and a table of contents.

I thought I would create a target Word document, export it as Rich Text Format (RTF), and then teach textbase.pl to emit records in that format. This was a dismal failure. RTF is nasty stuff—hard to read, hard to write.

Here's the solution I came up with. I wrote a Visual Basic for Applications (VBA) module with the following routines:

```
DoTable
  - insert a table into a document
DoCell
  - insert a value into a table
DoText
  - insert a chunk of free text
DoPage
  - build a page using a series of
     DoTable and DoText calls
DoPages
 - call DoPage many times
```

Here's a sample VBA declaration of `DoPage`:

```
Sub DoPage(name, email)
```

And here's a sample use of `DoPage`:

```
Call DoPage(
   "Jon Udell", "jon@byte.com")
```

This VBA code is another kind of template. To adapt it to a particular textbase, you declare a version of `DoPage` with a list of arguments corresponding to the fields of that textbase. Then you write an implementation of `DoPage` that emits the values of those fields as a series of tables or text chunks.

Of course, if your textbase has 1000 records, each containing 37 fields, this is not a VBA program that any sane person would ever want to write. Fortunately, there's no need to. Perl can write it for you. That's just what textbase.pl does. Actually, it only does the hard part—the declaration of `DoPage`, plus a bunch of parameterized calls (one per textbase record) to that routine. I incorporate this output into a VBA skeleton for my textbase, run the VBA macro, and voilà! Word builds a catalog automatically.

This technique underscores yet again the protean power of Perl. As USENIX president Andrew Hume likes to say, "Programs that write programs are the happiest programs in the world." Perl's a great language in which to write programs that write programs.

I've also learned a few things about the limitations of VBA. On my first try, textbase.pl simply wrote out `DoPage` calls once per line. That was fine for simple textbases. But when I tried it on a big textbase with many dozens of fields per record, I ran smack into two hard limits. First, you can't pass more than 63 arguments on a VBA call. Second, you can't hand the VBA interpreter a line that's longer than 1023 characters.

Oops. So much for taking the simple approach. Perl doesn't suffer from either of these limitations—you can pass ridiculous numbers of arguments to functions and create insanely large strings—but to accommodate VBA, I had to decompose everything.

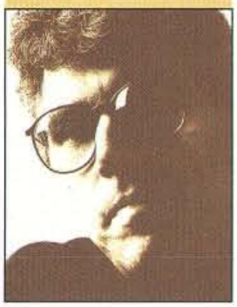
The final solution that I came up with passes the data to VBA in files. Not just a file per record, either. I had to go all the way to file-per-field granularity. It's ugly, but it works.

Textbase.pl isn't (yet) a user-friendly, turnkey solution. But it's an inexpensive, portable, lightweight, effective, and extensible way to manage text data on the Web or your intranet. B

Jon Udell is BYTE's executive editor for new media. You can reach him by sending e-mail to **jon_u@dev5.byte.com.**

Rick Grehan

Javatalk



Visual Age for Java

IBM's Visual Age for Java isn't just beans.

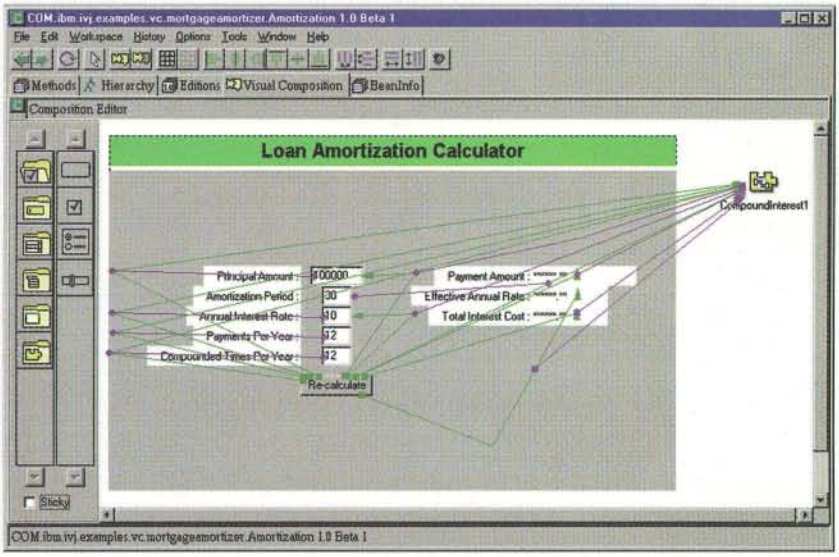
I have always admired the Visual Age parts paradigm and how well you can use it to build visual and nonvisual applications. I've covered IBM's Visual Age products before (see "A New Age for OS/2 Programmers," October 1995 BYTE, p. 46, and "Visual Age for BASIC... Sort Of," November 1996 BYTE). It was only a matter of time before a Java version appeared.

If you like Visual Age's parts paradigm, you'll feel at ease using Visual Age for Java. VAJ easily carries the parts concept into the Java world. A new aspect of Visual Age is a welcome surprise. IBM recognized that it had to beef up VAJ with several programming assistance wizards (referred to in this product as builders) so that it could carry out its main mission: to help programmers build distributed Java applications.

This is an area where I have to be careful. In the Java world, the word *application* has a special meaning. It identifies a Java program that can run stand-alone (in other words, it's not an applet and doesn't need to execute in a Java-enabled browser). More precisely, then: The main purpose of VAJ is to help programmers build distributed Java packages, where a package can include one or more Java applets. The distributed nature of the package comes into play when one or more beans in a Java applet are executing remotely on a Java server.

The Power of Remote Beans

The Java version of Visual Age is built on beans. IBM would probably prefer the previous sentence to read that it's "built on parts." In this case, however, a bean and a part are the same thing. Because Java beans are components providing both design-time and execution-time behaviors, they have all the ingredients needed to reincarnate a part—in the Visual Age sense—in the Java world.


COM.ibm.ivj.examples.vc.mortgageamortizer.Amortization 1.0 Beta 1
File Edit Workspace History Options Tools Window Help
Methods
Hierarchy
Editions
Visual Composition
BeanInfo
Composition Editor
Loan Amortization Calculator
CompoundInterest1
Re-calculate
Sticky
COM.ibm.ivj.examples.vc.mortgageamortizer.Amortization 1.0 Beta 1

Principal Amount : 100000
Amortization Period : 30
Annual Interest Rate : 10
Payments Per Year : 12
Compounded Times Per Year : 12
Payment Amount :
Effective Annual Rate :
Total Interest Cost :

VAJ brings Visual Age's program-by-wiring paradigm to the Java language.

From within the program's integrated development environment (IDE), you can drag and drop parts taken from a parts palette into the visual composer window. These parts are simply Java beans; in fact, you can import a Java bean into the VAJ environment, and it immediately becomes a usable part. VAJ reads the bean's interface, locating methods and events, and automatically incorporates them into the IDE.

Another important technology is Java's remote method invocation (RMI). RMI lets a Java application or applet invoke an object's method across the wire. In other words, a Java application on one machine can execute a method within a Java object on another machine. More important, the calling application has no idea that the invoked method is remote. RMI provides the communications plumbing needed to distribute an application.

The beta version of VAJ that I tested comprised two programs, the IDE and the enterprise application builder (EAB). IBM officials say that the commercial release of the program, which will run on Windows 95 or NT, will merge the two programs to create a single package.

The IDE includes the editor, compiler, browsers, and other modules. It masks the fact that a project is a collection of files. Instead, you move smoothly from project to class to source code. The IDE's incremental compile capability speeds up the applications-development cycle. VAJ

PHOTOGRAPH: KELLIE WALSH © 1997

Java in the Real World

Java's original target was not desktop browsers; it was conceived as a language for "smart," embeddable appliances. Java, as we know it in our Web browsers, requires several megabytes to live comfortably. JavaSoft, in an ongoing effort to make Java portable not only across system types, but across system sizes as well, is in the process of releasing APIs that specify Java environments that are more appropriate for embedded devices.

The specifications for EmbeddedJava and PersonalJava may be available by the time you read this (JavaSoft plans the final release in the third quarter). The Java Card API–targeted for super low-resource smartcards–is already available. Schlumberger has already built a Java smartcard using Motorola's 6805 8-bit processor.

However, making Java smaller doesn't meet the requirements of real-time systems, particularly *hard* real-time systems. According to Curtis Sasaki, JavaSoft's product line manager for JavaOS and JavaPC, JavaSoft is investigating not only the construction of a deterministic garbage collector for the Java Virtual Machine (JVM)–which is needed for hard real-time performance–but is also designing the JVM so that you can plug in your favorite garbage collector. This would let you tailor your JVM to the specific memory needs of your application.

NewMonics (Ames, IA, 515-296-0897) is unwilling to wait for JavaSoft. Its Portable Environment for Real-time Control is an effort to anoint Java with the ingredients necessary to make it a viable real-time environment. This involves additions to the language syntax, adding real-time class libraries, a special compiler, and a modified JVM.

PERC extends the Java syntax with two new statement types: `timed` and `atomic`. Code in a `timed` statement must execute in a specified amount of time. For example, the following listing shows a `timed` segment of code in which `method1()` must execute within 100 microseconds:

```
timed(Time.us(100)) {
  method1();
}
```

The syntax for the `atomic` statement is similar (though there is no attached argument, as with `timed`). Code that's governed by an `atomic` statement must execute to completion, or it won't execute at all.

Even with these alterations, the PERC system has not abandoned portability. The `timed` and `atomic` statements, when compiled by the PERC compiler, appear in the final bytecodes as special *attributes*. A standard JVM ignores these attributes, so PERC-compiled code won't break a JVM. PERC provides a modified JVM (called a PVM), which includes support for real-time operations.

Furthermore, NewMonics has written the `p2jpp` front-end compiler, which can compile PERC code into standard Java code. The features of `atomic` and `timed` statements are handled by special classes and objects supplied by NewMonics. Consequently, you can compile PERC-specific code to run on a standard JVM, although you'll lose some of the PVM's benefits, such as deterministic scheduling and garbage collecting.

Get Active

In the PERC view of things, a real-time program is a set of activities. Each activity shepherds a given aspect of the system. Therefore, one activity might manage a front-panel display, while another activity would communicate with the hardware that's controlled by that display.

PERC captures this abstract notion of an activity into a class. Activity objects, in one sense, are containers, because they gather the tasks that manage the object's associated real-world behavior.

In another sense, each activity object is a kind of environment. The details of that environment are dictated by the properties of the activity. Some activities require more resources, others less. As part of its initialization, an activity object must enter into a resource negotiation with the run-time system. In other words, the activity object communicates with the real-time manager in the PVM, informing the kernel of the CPU time and memory requirements that the activity's tasks will need.

The PVM returns a two-part response that tells the petitioning activity the resource quantities that the PVM can guarantee, as well as those quantities that it can expect to provide. The calling activity must then determine whether to accept or reject the response. This negotiation takes place at run time, letting a real-time application adjust itself to whatever platform it finds itself on.

At this point, it's unclear whether PERC will succeed out from underneath the JavaSoft umbrella. Because PERC extends the syntax of Java and modifies the JVM, NewMonics is unable to officially attach the Java name to PERC. So far, Integrated Systems has signed a license to include the PERC system in its well-known real-time OS (RTOS), pSOS. Kelvin Nilsen, founder of NewMonics, says that he is pursuing other RTOS vendors. I hope he succeeds.

---

is also team-aware—its repository-based source control mechanism lets multiple developers work on a project simultaneously. Additionally, VAJ retains the Visual Age program-by-wiring paradigm. You populate a form with parts (in this case, they are called beans) and define the behavior of the application by wiring a source part to a destination part and specifying the nature of that connection.

The EAB is a collection of four wizards: data access builder, C++ access builder, Customer Information Control System (CICS) access builder, and RMI access builder. The EAB allows existing data applications to deliver content over the Web. Each builder guides you through a remarkably small number of steps for building wrapper Java code.

For example, if you point the data access builder at an ODBC database, it automatically builds a collection of classes that—via Java Database Connectivity (JDBC)—can read, add, delete, or update the contents of the database. You have to identify which columns you want to access, but beyond those simple specifications, data access builder does the rest. Similarly, C++ access builder provides Java wrapper code for accessing C++ applications, CICS access builder links your Java code to CICS transactions, and RMI access builder constructs the necessary stub and proxy code for calling Java methods remotely.

At the time of this writing, Visual Age for Java was due for release at the end of June. IBM had not yet set pricing. If the final version is anything like the beta version, VAJ will join the likes of Delphi and Optima as a robust client/server development system.

WHERE TO FIND

Visual Age for Java
http://www.software.ibm.com/ad/vajava

Rick Grehan is a senior editor at Computer Design *and coauthor of* The Client/Server Toolkit *(NobleNet). You can send e-mail to him at* **rickg@pennwell.com.**

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And you wonder how much he knows about transmissions.

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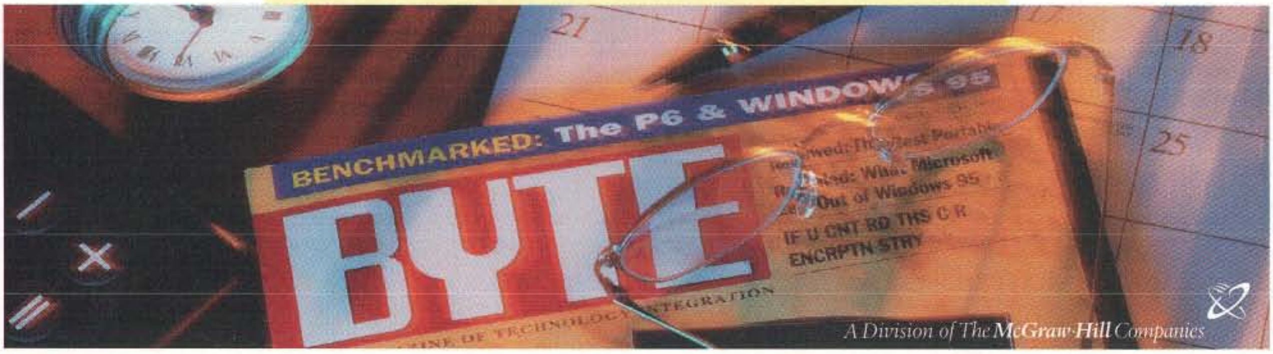

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ab Report

Hardware

Stretching the envelope, MMX PCs marry a compelling mix of performance and promise.

By BYTE Editors

MMX Power for Desktop PCs

The invention of the microprocessor changed the world and ushered in an era of continually rising expectations. As we moved from the 8088 to the 286 and 386, we assumed that each new microprocessor generation would run faster and deliver better performance. We believed that improvements in microprocessors would continue to be fueled by increasing clock speeds, improving cache management, and optimizing architecture.

Recently, however, the microprocessor industry has had to confront cold, hard reality. The introduction of new CPUs that differ little—if any—from their immediate predecessors has left the market confused. As a result, the evolution of the x86 microprocessor is showing the first signs of slowing.

Intel's introduction of multimedia extensions (MMX) is the first major expansion of the x86 instruction set since the 386, and it makes a bold statement: CISC computers are alive and well. The 57 new MMX instructions perform multiple mathematical operations on sets of multiple data items simultaneously. The potential result is powerful programs that can do more, do it faster, and use fewer instructions.

Intel designed the MMX instructions with multimedia applications in mind. MMX should find its greatest use in the bit- and byte-oriented algorithms typically employed in audio and video compression and decompression, image processing, and rendering.

Surprisingly, Intel chose to debut MMX not in its high-end Pentium Pro, but in its established (and more profitable) line of Pentium processors. Despite its obvious advantages for business applications, Intel is promoting MMX with a marketing campaign that is decidedly consumer-oriented.

A Wide Field

There's no shortage of manufacturers eager to sell you an MMX PC. For this Lab Report, we gathered 10 systems from eight vendors. We asked them to provide desktop systems powered by a 200-MHz MMX Pentium processor. We also received a 233-MHz MMX Pentium system and a 200-MHz AMD K6 system. All systems had 32 MB of RAM and ran Windows 95. Also mandatory was a 12-speed or faster internal CD-ROM drive, a PCI video adapter with 4 MB of memory, and a 3-GB hard drive.

BYTE BEST

MMX DESKTOP PCS

Gateway 2000 P5-200

Polywell Computers Poly 5200Tx

Gateway was the overall winner with consistently high performance scores and excellent usability. The Polywell system was a close second in overall score, and its low price makes it the bargain of the batch.

System prices (not including a monitor) ranged from $1750 to a pricey $2949. Sound cards, modems, Zip drives, and other extra equipment were neither required nor explicitly tested.

Because they were configured similarly and built around identical CPUs (except for the K6 system), it should come as no surprise that these systems turned in roughly similar performance. Each is well suited for the role of office or home PC. Therefore, to distinguish these systems, we also evaluated features and usability, including the quality and quantity of the documentation.

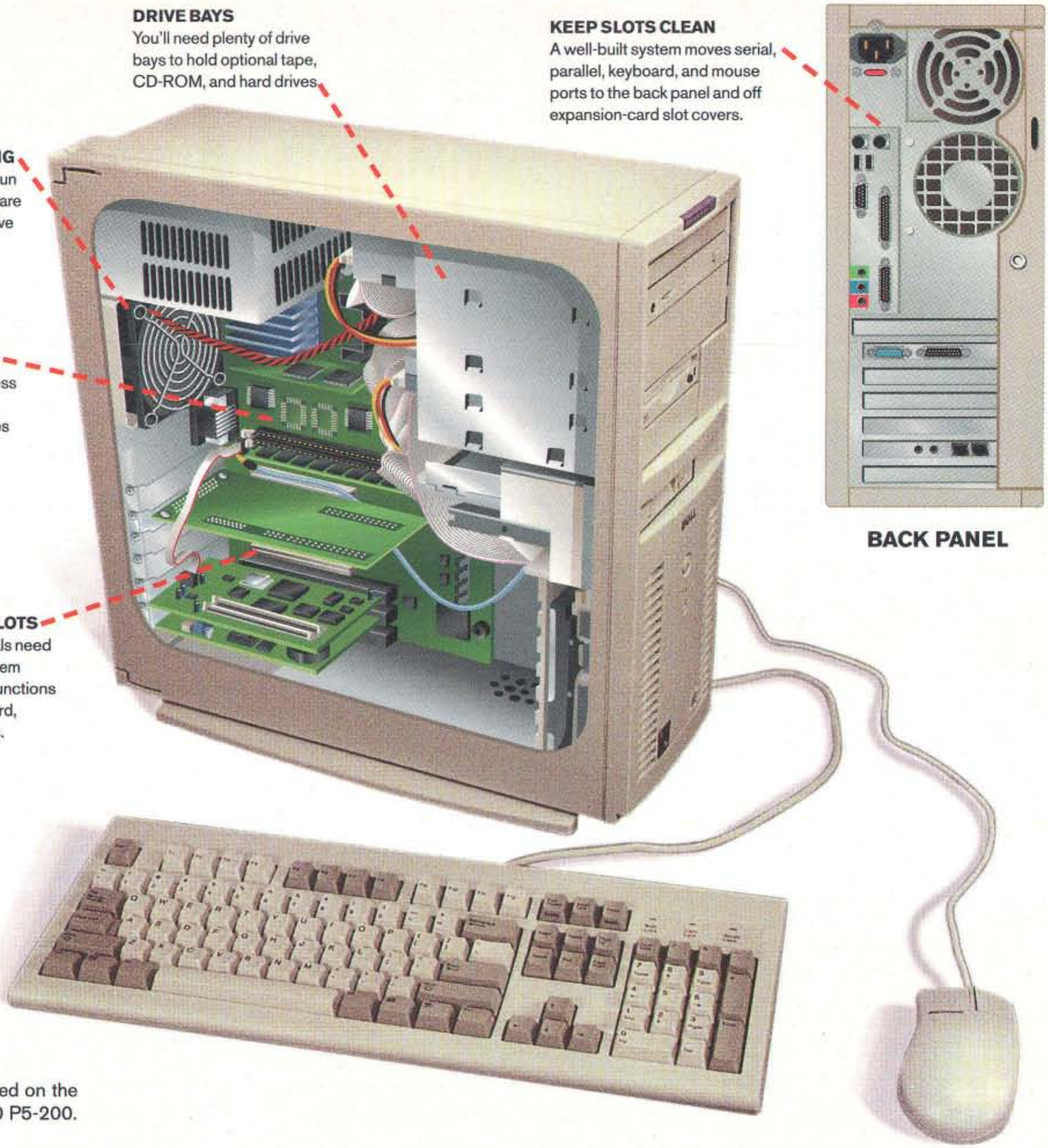
Systems from three established vendors are notably absent. Hewlett-Packard declined to submit a system, claiming our testing emphasizes system performance too heavily when assigning an overall rating. IBM begged off, explaining that it had no PCs suitable for this product category. Compaq said its MMX Pentium system would not be ready in time.

The Market

The technology and performance of microprocessors and intelligent subsystems have far outpaced the needs of OSes and applications. An animated cursor or audio clip embedded in a Word document may provide a momentary thrill, but they hardly require a 200-MHz Pentium. So who needs MMX?

If most of your computing involves standard Windows 95 applications, you'll be disappointed with the MMX Pentium. Compared to a standard Pentium running at the same clock speed, you'll see only a fractional performance improvement—about 10 percent to 20 percent. This is attributable solely to the MMX Pentium's larger on-chip L1 cache (up from 16 KB to 32 KB). You'll be hard-pressed to justify a new MMX system for such a small gain.

Currently, neither Windows 95 nor any standard office application has been rewritten to take advantage of the MMX instructions. Even if these applications



DRIVE BAYS
You'll need plenty of drive bays to hold optional tape, CD-ROM, and hard drives.

KEEP SLOTS CLEAN
A well-built system moves serial, parallel, keyboard, and mouse ports to the back panel and off expansion-card slot covers.

EXTRA COOLING
Loaded systems run hot. Auxiliary fans are required for passive CPU heat sinks.

EASY ACCESS
Unhindered access to the CPU and SIMM slots makes upgrades easy.

EXPANSION SLOTS
Special peripherals need slots. A good system moves common functions to the system board, freeing more slots.

BACK PANEL

Illustration based on the Gateway 2000 P5-200.

ILLUSTRATIONS: SANDERS/TIKKANEN DESIGN & ILLUSTRATION © 1997

were retooled, the percentage of their code that would realize a significant performance improvement is minor. Office applications, despite being loaded with multimedia-like fluff, run just fine on non-MMX Pentium systems.

The first serious applications to target MMX are those with intensive graphics calculations, such as Adobe Photoshop and PhotoDeluxe, Kai's Power Goo, and Vream's WIRL Virtual Reality Modeling Language (VRML) browser. If graphics manipulation and rendering are a major part of your work load, MMX-enabled PCs and applications may deliver serious productivity improvements. Also, 3-D game developers will appreciate MMX.

The Upgrade Conundrum

There's not yet a compelling reason to replace your current PC with an MMX Pentium system. If you're shopping for a new PC or a long-overdue upgrade, however, consider MMX seriously. The price difference between the older Pentium and the newer MMX is typically only a few hundred dollars. Substitute an AMD K6, and the price difference almost disappears. Even if your applications can't take advantage of MMX directly, you'll benefit from the increased cache and other architecture improvements.

Intel plans to incorporate the new MMX instructions into all its future CPUs. However, the classic Pentium and Pentium Pro microprocessors—soon to be replaced by the Pentium II—will remain strong sellers into the near future.

Given the enormous installed base of non-MMX machines, it is virtually certain that all popular software will be available in non-MMX versions for the foreseeable future. Ultimately, it will be the applications-software developers who will decide if MMX becomes a niche or mainstream technology.

Contributors
Dorothy Hudson, Project Manager/NSTL
Robert Hummel, freelance writer/BYTE

Best Overall

PENTIUM MMX SYSTEMS

Any one of the 10 MMX desktop systems we evaluated would make a valuable addition to any office or home. Loaded with 32 MB of RAM and bleeding-edge CPUs, these systems turn in excellent performance on current Windows applications. Also, their MMX-enabled CPUs promise the ability to boost the execution of forthcoming MMX-specific applications and OSes.

For the majority of users, sculpted cases and fancy colors hold little sway. If you're buying a 200-MHz Pentium system, you have only one objective in mind: performance. It's appropriate, therefore, that we gave the performance scores a hefty 60 percent weighting when determining our Best Overall winner.

Of course, performance isn't the whole picture. To differentiate their systems, vendors try to add value in the form of features such as universal serial bus (USB) ports and extra drive bays. Problems during installation and setup of these machines, as well as the ease of access and future upgrading, are also important considerations. We allocated 20 percent of the Best Overall score to features and 10 percent to usability, which, when combined with the 5 percent weighting for value, results in an Implementation score. The final 5 percent rates the system's innovativeness.

The Best Overall winner was the Gateway 2000 P5-200. Although it didn't turn in the top marks on any single benchmark test or category, its rating was consistently near the top in every category. This gave it enough of an edge to push it into first place by a hair.

The Polywell Computers Poly 5200Tx placed second, turning in top scores in both the Excel and Word benchmarks. The Micro Express MicroFLEX-MMX/200's steady performance and slightly better feature score put it in a virtual tie with the Polywell system.

The sole K6 system we tested, XI Computer's Xi K200 MTower, turned in a composite performance score nearly identical to that of its MMX Pentium counterparts. On individual tests, the K6 system performed better in primarily integer environments, such as when running Word, FoxPro, and video-subsystem tasks. We took this system and swapped out the K6 for an MMX Pentium; this configuration performed better when running Excel and the MMX benchmark.

Frankly, we were surprised to see such a wide variation in the scores for Intel's MMX benchmark. The results had no discernible correlation to the video system or processor speed. One vendor indicated that many current BIOS and chip-set implementations failed to execute some video-acceleration techniques, such as VGA frame buffering, partially negating the advantage of the MMX instructions. Systems built around these components may fail to deliver full MMX potential, even when new applications are available. Digital Equipment has

The K6 Alternative

Intel invented, innovated, and has controlled the evolution of x86 chips from the 8088 to the Pentium Pro. There were a few blips on the radar, but generally other chip manufacturers have been relegated to carrying the train on Intel's gown.

With the Pentium Pro, however, optimized for 32-bit operations at the expense of 16-bit operations, Intel had outrun the installed base of OS and applications software. As long as the Pentium remained the chip of choice, a dangerous window of opportunity opened for other chips. To distinguish its products again, Intel created the multimedia extensions (MMX) Pentium.

The AMD K6-MMX, however, changes the PC landscape considerably. Introduced at the right time with ample power and a competitive price, the K6 might offer the first serious challenge to Intel's dominance.

Under the Hood

The K6 matches the Pentium Pro's excellent 32-bit performance without the Pentium Pro's characteristic slowdowns running 16-bit software. AMD uses a 0.35-micron, five-layer-metal process to manufacture the 8.8-million-transistor K6. This chip features the industry's largest L1 caches: a 32-KB data cache and a 32-KB instruction cache—twice those of the MMX Pentium. The K6 is currently available at clock speeds of 166, 200, and 233 MHz, and 266- and 300-MHz versions are expected soon.

The K6 uses a six-issue RISC86 superscalar microarchitecture that's significantly different from that of the Pentium or Pentium Pro. The K6 microarchitecture decodes x86 instructions into simpler, fixed-length RISC86 op codes.

Some RISC techniques used in the K6 include multiple instruction decode, single-clock execution, out-of-order execution, data forwarding, speculative execution, and register renaming. In addition, the K6 implements an 8192-entry branch history table, a branch target cache, and a return address stack, which deliver a prediction rate greater than 95 percent. The K6 also contains seven execution units that enable superscalar operation in a six-stage pipeline.

Form and Function

Intel's dominance lets it dictate standards—witness its current attempt to move the industry toward plug-in CPU cards. AMD knows that it cannot demand change. Thus, the company went out of its way to ensure compatibility with existing packaging and system-interface standards.

The K6 uses a Socket 7–compatible, 321-pin ceramic pin grid array. OEMs can adapt current designs to fit the K6 without the R&D costs required for a new platform. The K6 itself is slightly less expensive than other sixth-generation processors, due in part to its compact die size.

Current K6 systems aren't perfect. Some vendors report disappointing video performance. Their testing indicates that existing chip sets and BIOSes, optimized for the older Pentium but not the MMX Pentium or Pentium II, may be holding back the K6 from its full performance. Nonetheless, as these problems are eliminated, the K6 will be a potent competitor to the Intel CPUs.

LAB RESULTS

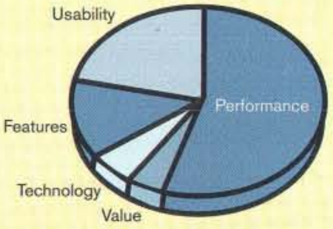
PENTIUM MMX DESKTOPS

BEST OVERALL

Gateway 200 P5-200

In a very close race, the Gateway system's consistently good scores in all categories helped it squeak into first place in the Best Overall category. The Polywell system's higher marks in performance and usability edged the Micro Express system, despite its better features score. Both systems were close enough to be awarded a tie for second place, just 3 percent behind the P5-200. Third place goes to the DTK Computer Quin-55M/PM233. The performance of any one of these 10 systems was within 6 percent of the average score.

WEIGHTING



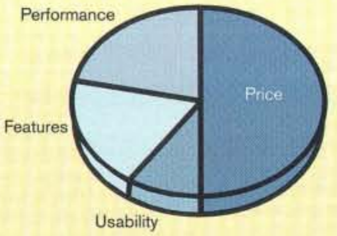
	PRICE	TECHNOLOGY	IMPLEMENTATION	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
Gateway 2000 P5-200	**$2124**	★★★★	★★★	★★★★★	★★★★★	★★★★	★★★★★
Polywell Poly 5200Tx	$1750	★★★★	★★★	★★★★★	★★★★★	★★★★	★★★★★
Micro Express MicroFLEX-MMX/200	$2295	★★★★	★★★	★★★★★	★★★★★	★★★★	★★★★★
DTK Quin-55M/PM233	$2050	★★★★	★★★	★★★★★	★★★	★★★★	★★★★★
Micron Electronics Millennia MXE P200	$2628	★★★★	★★★	★★★★★	★★★★★	★★★★	★★★★★

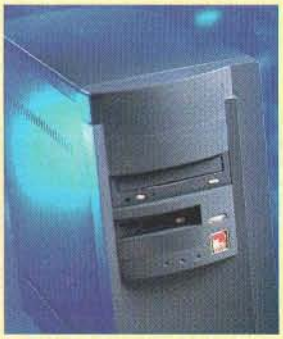
LOW COST (BEST VALUE)

Polywell Computers Poly 5200Tx

The rock-bottom $1750 price of the Poly 5200Tx nudged it into the low-cost winner's circle. It was helped by its good performance and usability scores to just edge past the DTK Computer Quin-55M/PM200, also a bargain at $1775. The Xi K200 MTower's $1899 price helped it overcome somewhat lackluster feature and usability scores and claim third place. With overall scores for these systems nearly on a par, it's not surprising that the three systems priced below $2000 pan out as the low-cost leaders.

WEIGHTING





	PRICE	TECHNOLOGY	IMPLEMENTATION	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
Polywell Poly 5200Tx	**$1750**	★★★★	★★★	★★★★★	★★★★★	★★★★	★★★★★
DTK Quin-55M/PM200	$1775	★★★★	★★★	★★★★★	★★★	★★★★	★★★★
XI K200 MTower	$1899	★★★★	★★★	★★★★★	★★★★	★★★★	★★★★
Gateway 2000 P5-200	$2124	★★★★	★★★	★★★★★	★★★★★	★★★★	★★★★★
DTK Quin-55M/PM233	$2050	★★★★	★★★	★★★★★	★★★	★★★★	★★★★★

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

PHOTOGRAPHS: LIGHTWORKS PHOTOGRAPHIC © 1997

apparently conquered that particular problem. Its Celebris FX-2 5200M LP turned in the best MMX benchmark score, but it was only sixth overall.

Cutting Costs

We may be lured by blistering performance and tempted by fancy features, but price brings us back to reality. The competition among PC vendors for your business is fierce. Three systems in this roundup illustrate that high performance on a rock-bottom budget is an attainable goal.

In picking a low-cost winner, we shifted our priorities to emphasize price. It determined 50 percent of the overall score. We based 20 percent of the overall score on features and another 20 percent on performance. Usability made up the remaining 10 percent.

Not unsurprisingly, the systems with the lowest price came over the line one-two-three. The Polywell Poly 5200Tx's $1750 price tag and second-place finish in the Best Overall category make it clearly the best value for the dollar. Just behind it—in essentially a statistical dead heat—the DTK Computer Quin-55M/PM200 takes honors as the second-best bargain of the group. Finally, the Xi K200 MTower, the sole K6 machine, ameliorated its indifferent feature and usability scores with a bargain price.

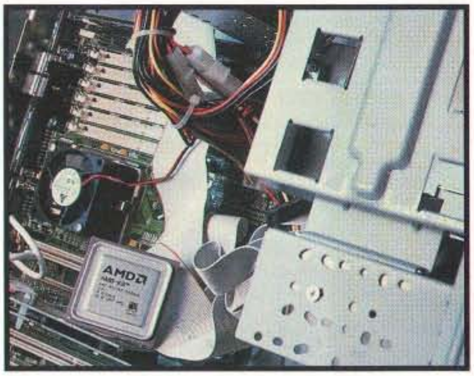
Details

Watts the Deal?

The new MMX chips generate less heat than older Pentiums, but they run hot. Because convection systems pull air over the CPU, heat sinks and a closed cabinet are required to get adequate airflow. A CPU-mounted heat sink cuts down on both required airflow and fan noise but doesn't cool the cabinet.

Yearning to Be Different

While other vendors produce towers, Digital offers a low-profile PC that will fit conveniently under your monitor. Network, video, and I/O ports on the system board save space and slots. However, you won't have to get too ambitious before the Celebris's miserly two expansion slots and lack of drive bays will cramp your style.



A Choice of Chips

Designed to plug into a Pentium socket, the AMD K6 gives vendors an easy way to offer MMX compatibility. The K6 exhibits excellent performance on both 16- and 32-bit software, making it a superb platform for today's mixed bag of office productivity applications. And aggressive pricing means buying a K6 can shave a few hundred dollars off the cost of your next system.

TECH FOCUS WHAT IS MMX?

Warning: Marketing Hype Ahead

You've browsed the advertisements, read the reviews, and seen the television commercials. But unless you spend your time poring over technical manuals, you probably still don't have a solid idea of just what Intel's multimedia extensions (MMX) technology is.

Let's cut to the chase. Calling MMX a technology is like describing a wood screw as a helically bifurcated affixation mechanism. MMX is simply a group of new instructions that Intel designed to perform tasks useful in multimedia applications. Intel called these instructions the MMX technology because no one would have cared if it simply announced: "Pentium—Now with 57 new instructions!"

Despite the hype, the MMX instructions do represent a significant upgrade to the x86 instruction set, the first since the introduction of the 386. Based on an analysis of the algorithms performed during graphics and image manipulation, video display, music synthesis, and speech processing, the MMX instructions represent Intel's best effort at encapsulating more work into fewer instructions.

DATA MASQUERADE

To create room to work, an MMX CPU uses aliases for the chip's cluster of floating-point registers. Instead of viewing these registers as containing floating-point numbers, the MMX instructions might treat them as eight packed 8-bit integer values. When an MMX instruction executes, it takes all eight values from the MMX register, operates on them in parallel, and writes the result into another MMX register.

It might seem that the MMX instructions' use of the floating-point registers would cause incompatibility or a conflict with normal mathematical use. Fortunately, properly written software always assumes that someone else is using the floating-point hardware and preserves its state before switching from one task to another.

HARDWARE IT'S NOT

Don't forget that MMX is still a software solution. An outboard coprocessor, such as a video accelerator or digital signal processor (DSP) chip on a sound card, can perform its functions independent of the PC's CPU, multiplying the power of the system as a whole. When the CPU is executing an MMX instruction, however, it cannot be doing something else at the same time.

Overall CPU use will increase as more MMX instructions are in use, until eventually system performance degrades. The only potential gain is when non-MMX CPU-based calculation can be streamlined by using MMX instructions.

Also remember that no current OSes recognize or exploit MMX-capable CPUs. An MMX-aware OS would switch device drivers or core code, for example, when it detected an MMX CPU. Instead, each application must be individually MMX-enabled by its developer. Thus, the need to create two sets of software for each product and a lack of widespread availability of MMX tools are sure to make the transition to MMX a slow one.

Test Specs

Buying a multimedia extensions (MMX) desktop PC to run ordinary applications makes sense if you're overdue for an upgrade. The larger cache and improved architecture of the MMX Pentium and likely improvements in the system chip set and BIOS mean you'll probably see enough of a performance boost to justify the extra cost over an ordinary Pentium. However, until more MMX-enabled applications arrive, or until MMX instructions are incorporated into Windows, your new system won't realize its full potential.

To test performance, we used a suite of individual benchmarks. Three are application-based, running tasks under Microsoft Word, Excel, and FoxPro. NSTL's proprietary InterMark test measures system performance. Finally, we used Intel's MMX benchmark. We ran all tests under Windows 95.

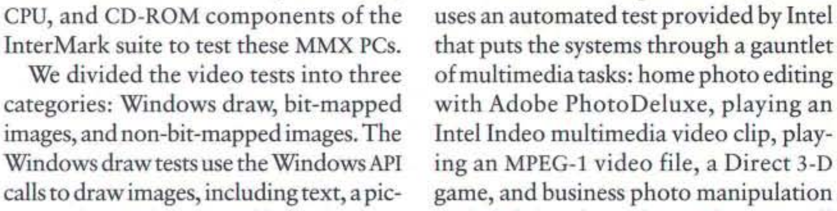
The Word test performs a mix of operations that simulate intensive word processing. The File I/O test stresses a system's hard drive subsystem. The Insert, Paste, Select, and Format tests work the video. The Calculation, Compare, and Sort tests primarily measure the efficiency of the processor and memory.

The Excel test emphasizes floating-point calculation as well as housekeeping operations. The Clear, Insert, Delete, Paste, and Screen tests stress a system's video subsystem. The Calculation test measures the processor and hard drive efficiency, while the File I/O test works a system's hard drive subsystem.

The Microsoft FoxPro 2.6 for Windows benchmark uses five database tables: link, book, authors, order, and entry. The test runs Extended Edition FoxPro, which uses the system's available extended memory for caching. The FoxPro benchmark stresses a system's CPU processing, the hard drive subsystem, and the memory subsystem.

NSTL's InterMark benchmark tool profiles applications by capturing the system calls and actions. InterMark then replays these actions to test a system's components without the need for third-party applications. A precision event timer measures the response time for each task. NSTL used the video, hard drive, CPU, and CD-ROM components of the InterMark suite to test these MMX PCs.

We divided the video tests into three categories: Windows draw, bit-mapped images, and non-bit-mapped images. The Windows draw tests use the Windows API calls to draw images, including text, a picture in the Windows metafile format, horizontal and vertical lines, rectangles, and ellipses. Images are then stretched to one and one-half and then twice their original size.



At $1750, Polywell Computers' Poly 5200Tx offers the most bang for the buck.

Hard drive tests measure the speed of the hard drive for reading and writing. They simulate sequential, constant-rate sequential, random, localized-random, and segmented activity in varying block sizes. The result is a measurement of the average response time, the sustained rate, the burst rate, the random-access time, and CPU use of the hard drive.

CPU tests measure processor performance for both integer and floating-point calculations. These tests provide an index of the computing power of the processor. CD-ROM tests examine several aspects of CD-ROM performance: random service time at 500 and 1000 milliseconds, cached service time at 13.3 milliseconds, and CPU use at 550 KBps.

To measure MMX performance, NSTL uses an automated test provided by Intel that puts the systems through a gauntlet of multimedia tasks: home photo editing with Adobe PhotoDeluxe, playing an Intel Indeo multimedia video clip, playing an MPEG-1 video file, a Direct 3-D game, and business photo manipulation with Adobe Photoshop. These are all common tasks that the MMX technology is designed to exploit.

We also evaluated the systems for usability. Our checklist includes a large number of items, ranging from how easy it is to open the case to whether setup and configuration utilities are stored in CMOS or on disk. We like to see ports labeled on the rear panel, zero insertion force (ZIF) sockets for CPUs, and a healthy dose of clear, helpful documentation.

Evaluations in this report represent the judgment of BYTE editors, based on tests conducted by NSTL, Inc., as documented in a recent issue of their monthly PC Digest. *To purchase a copy of the full report, contact NSTL at 625 Ridge Pike, Conshohocken, PA 19428; (610) 941-9600; fax (610) 941-9950; on the Internet, editors@nstl.com. For a subscription, call (800) 257-9402. BYTE Magazine and NSTL are both operating units of The McGraw-Hill Companies, Inc.*

MMX DESKTOP PCS FEATURES

	Dell Computer Corp. Dimension XPS M200x MMX	Digital Equipment Corp. Celebris FX-2 5200M LP	DTK Computer, Inc. Quin-55M/PM200	DTK Computer. Inc. Quin-55M/PM233
Price as tested (MSRP)	$2949	$2517	$1775	$2050
Overall rating	★★★★	★★★★★	★★★★	★★★★★
MICROPROCESSOR				
Manufacturer and model	Intel Pentium MMX 200	Intel Pentium MMX 200	Intel Pentium MMX 200	Intel Pentium MMX 233
BIOS vendor and version	AMI AO5	Phoenix 4.05.12	AMI 451 PG	AMI 451 PG
ISA PNP flash BIOS	✓	✓	✓	✓
DMI-compliant		✓	✓	✓
Setup on	Disk	ROM	ROM	ROM
BIOS shadowing	ROM, video	ROM, video	ROM, video	ROM, video
Shadowing RAM (KB)	256	1024	384	384
MEMORY				
Max. RAM on motherboard (MB)	64	256	384	384
RAM type	SDRAM	SDRAM	EDO	EDO
Memory architecture	Paged, fast-paged	Cached, paged	Fast-paged	Fast-paged
Memory speed	66	10	60	60
ECC RAM on motherboard			✓	✓
Both EDO and L2 cache installed		✓	✓	✓
Ext. RAM cache installed/max. ext. RAM cache installed	512/512	512/512	512/512	512/512
Ext. RAM cache mapping	Direct-mapping	Direct-mapping	Direct-mapping	Direct-mapping
Ext. RAM cache architecture	Write-back	Write-back	Write-back	Write-back
Ext. RAM execution type	Pipeline/SyncBurst	Pipeline/SyncBurst	Pipeline/SyncBurst	Pipeline/SyncBurst
Ext. RAM cache speed (ns)	12	12	8	8
MASS STORAGE				
Hard drive manufacturer and model	IBM DCAA-34330	Quantum Stratus ST2100	Western Digital AC33100	Western Digital AC33100
Hard drive interface type	Enhanced IDE	Enhanced IDE	Enhanced IDE	Enhanced IDE
Hard drive capacity (GB)	4.3	2.1	3.1	3.1
Hard drive access time (ms)	9.5	15.56	12	12
DRIVE BAYS				
Half-height 5-inch bays (total/exposed)	2/2	2/1	4/4	4/4
Half-height 3-inch bays (total/exposed)	5/3	2/0	4/1	4/1
CD-ROM manufacturer, model, and speed	Mitsumi TX 12T 12×	Mitsumi FX1600 16×	Sony CDU-511 16×	Toshiba XM-5702B 12×
VIDEO				
Video on system board		✓		
Video accelerator manufacturer/model (all PCI)	Matrox Millennium	S3 Virge/GX	S3 Virge VX86C988	S3 Virge VX86C988
Video memory as tested/maximum	4/4	4/4	4/4	4/4
Video memory type	WRAM	SGRAM	VRAM	VRAM
Max. resolution without upgrade	1280 x 1024	1280 x 1024	1280 x 1024	1280 x 1024
64K colors at 1024	✓		✓	✓
PNP video adapter	✓	✓	✓	✓
Resolution sync switching	✓	✓	✓	✓
EXPANSION SLOTS				
Primary system architecture	ISA	PCI	ISA	ISA
Local Bus architecture	PCI	PCI	PCI	PCI
Bus-mastering slots	✓	✓	✓	✓
Filled/vacant 16-bit slots	0/0	0/2	2/1	2/1
Filled/vacant Local Bus slots	1/2	0/2	1/2	1/2
Shared slots	1	1	1	1
I/O				
Total number of serial ports	1	1	2	2
Parallel-port type	Enhanced	Selectable	Selectable	Selectable
Available SCSI-2 ports	N/A	N/A	N/A	N/A
Available EIDE ports	0	2	2	2
PC Card compatibility on desktop			✓	✓
MISCELLANEOUS				
Case type	Mini-tower	Low-profile	Mid-tower	Mid-tower
Power-supply rating	200	100	250	250
CUSTOMER SUPPORT				
Warranty length (years)/coverage	3/P, L, F, R	3/P, L, R	2/P, L	2/P, L
Phone	512-338-4400	508-460-8894	818-810-0098	818-810-0098
Toll-free phone	800-388-8542	800-722-9332	800-289-2385	800-289-2385
On-line address	http://www.dell.com	http://www.windows.digital.com	http://www.dtkcomputer.com	http://www.dtkcomputer.com
Inquiry no.	**1047**	**1048**	**1049**	**1050**

BYTE BEST = BYTE Best

✓ = yes;
N/A = not applicable.

Warranty: P = parts; L = labor;
F = freight to repair center; R = return to customer.

★★★★★ Outstanding
★★★★ Very Good
★★★ Good
★★ Fair
★ Poor

Gateway 2000 **P5-200** BYTE BEST	**Micro Express** **MicroFLEX-MMX/200**	**Micron Electronics** **Millennia MXE P200**	**Polywell Computers** **Poly 5200Tx** BYTE BEST	**XI Computer Corp.** **Xi K200 MTower**	**XI Computer Corp.** **Xi MX200 MTower**
$2124	$2295	$2628	$1750	$1899	$2099
★★★★★	★★★★★	★★★★★	★★★★★	★★★★	★★★★
Intel Pentium MMX 200	Intel Pentium MMX 200	Intel Pentium MMX 200	Intel Pentium MMX 200	AMD K6-MMX 200	Intel Pentium MMX 200
AMI 4	Award A04	Phoenix 4.05	Award 4.5G	Award 4.51G	Award 4.51G
✓	✓	✓	✓	✓	✓
✓			✓	✓	✓
Disk, ROM	ROM	ROM	ROM	ROM	ROM
ROM	ROM, video	ROM, video	ROM, video	ROM, video	ROM, video
N/A	128	640	128	384	384
128	256	32	128	256	256
SDRAM	EDO	EDO	EDO	EDO	EDO
Fast-paged	Fast-paged	Fast-paged	Fast-paged	Fast-paged	Fast-paged
8	60	60	60	10	10
					Fast-paged
✓	✓	✓	✓	✓	✓
512/512	512/512	512/512	512/512	512/512	512/512
Two-way set-associative	Direct-mapping	Four-way set-associative	Direct-mapping	Direct-mapping	Direct-mapping
Write-back	Write-back	Write-back	Selectable	Write-back	Write-back
Pipeline/SyncBurst	Pipeline/SyncBurst	Pipeline/SyncBurst	Pipeline/SyncBurst	Pipeline/SyncBurst	Pipeline/SyncBurst
12	20	15	8	7	7
Maxtor Diamond Max	Maxtor 85120A	Western Digital AC33100	Maxtor 85120A	Maxtor 85120A8	Maxtor 85120A8
Enhanced IDE	Enhanced IDE	Enhanced IDE	Enhanced IDE	Enhanced IDE	Enhanced IDE
5.1	5.1	3.1	5.1	4.8	4.8
11	10	10.5	9	9	9
2/1	2/2	2/2	2/2	4/4	4/4
4/1	4/1	5/3	1/1	4/2	4/2
Toshiba XM-6002B 16×	Toshiba XM-5702B 12×	Hitachi CDR-8130 16×	Panasonic 584 12×	Hitachi CDR-8130 16×	Hitachi CDR-8130 16×
✓			✓		
S3 Virge/GX	S3 Virge	S3 Virge	S3 Virge 3D	S3 Virge/VX	S3 Virge/VX
4/8	4/8	4/4	4/4	8/8	8/8
DRAM	VRAM	DRAM	DRAM	VRAM	VRAM
1280 x 1024	1280 x 1024	1280 x 1024	1280 x 1024	1280 x 1024	1280 x 1024
✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓
PCI	ISA	ISA	ISA	ISA	ISA
PCI	PCI	PCI	PCI	PCI	PCI
✓		✓	✓	✓	✓
1/1	1/2	0/4	1/2	2/1	2/1
2/1	1/3	1/3	1/4	1/4	1/4
1	1	1	1	1	1
1	2	2	2	2	2
Enhanced	Enhanced	Selectable	Selectable	Selectable	Selectable
N/A	N/A	N/A	N/A	N/A	N/A
2	1	0	2	2	2
		✓	✓	✓	✓
Mini-tower	Mid-tower	Mini-tower	Mid-tower	Mid-tower	Mid-tower
145	230	235	230	250	250
3/P, L, R	2/P, L, F, R	3/P, L, R	3/P; 5/L	3/P, L, F, R	3/P, L, F, R
605-232-2000	714-852-1400	208-893-3434	415-583-7222	714-498-0858	714-498-0858
800-846-2000	800-989-9900	800-438-3343	800-999-1278	800-432-0486	800-432-0486
http://www.gw2k.com	http://www.microexpress.net	http://www.micronpc.web	http://www.polywell.com	http://www.xicomputer.com	http://www.xicomputer.com
1051	**1052**	**1053**	**1054**	**1055**	**1056**

Application-hosting servers add a new layer of interactivity to Web sites.

By David Seachrist and Stephen Platt

Web Applications at Your Service

The difference between plain-vanilla Web servers and Web applications servers is like the difference between two types of stores: one where consumers can do nothing but walk in and look at a catalog, and one where they can find and buy the product they want within minutes. Simple static Web publishing is cool, but providing applications services and access to actual databases is much cooler.

However, distributing dynamic content and applications can stress out protocols and server platforms intended for simple, static data publishing. Platform constraints, integration of legacy applications, object distribution and storage, and transaction processing all impose some serious limitations on the current crop of static Web-server products, preventing them from functioning as—or from quickly evolving into—robust and optimized applications servers.

For this report, we tested four Web applications servers, examining three on Windows NT and one on Unix. Included were Lotus Development's Lotus Domino Server 4.5a for Windows NT, Microsoft's Internet Information Server (IIS) 3.0 for Windows NT 4.0, and Netscape Communications' Netscape Enterprise Server 2.01, for both Windows NT and Unix. Each vendor has its own agenda: Lotus wants to leverage its dominance in the groupware/middleware market and expose the functionality of its Notes product to the Web; Microsoft wants to sell OSes and induce users to move to the Windows NT Server platform; and Netscape wants to continue to dominate the Web-server market by aggressively pushing platform-independent technologies and bringing innovative new products to market.

Product roundups would be easier to do if all the vendors could agree to a single release date. But unfortunately, Netscape's Enterprise Server 3.0 upgrade and Oracle's Web Application Server (WAS) 3.0 missed our deadline. See the text box "These Servers Missed the Bus" on page 118 for more about how these products will affect the category.

The Web App Story

You need a lot of types of support to publish a Web application—to name a few, support for Internet protocols, data/object store services, and groupware capabilities, such as calendaring and group scheduling. The servers we tested include most of the important features, either as a standard part of the package or as options. The most important ones for Web applications servers are HTTP support, a database server, messaging services, and a full-text search engine.

BYTE BEST

WEB APPLICATIONS SERVERS

Microsoft Internet Information Server 3.0

It's fast, administration and user management are tightly integrated with Windows NT, and it comes in a bundle that includes Index Server, Crystal Report Writer, NetShow, FrontPage, and Active Server Page technology. IIS serves static and dynamic Web pages simply and quickly.

All three vendors support HTTP in their products, but only Domino includes database and messaging services as standard. IIS and Enterprise Server require optional or third-party database and messaging services; only Enterprise Server supports the IMAP e-mail standard.

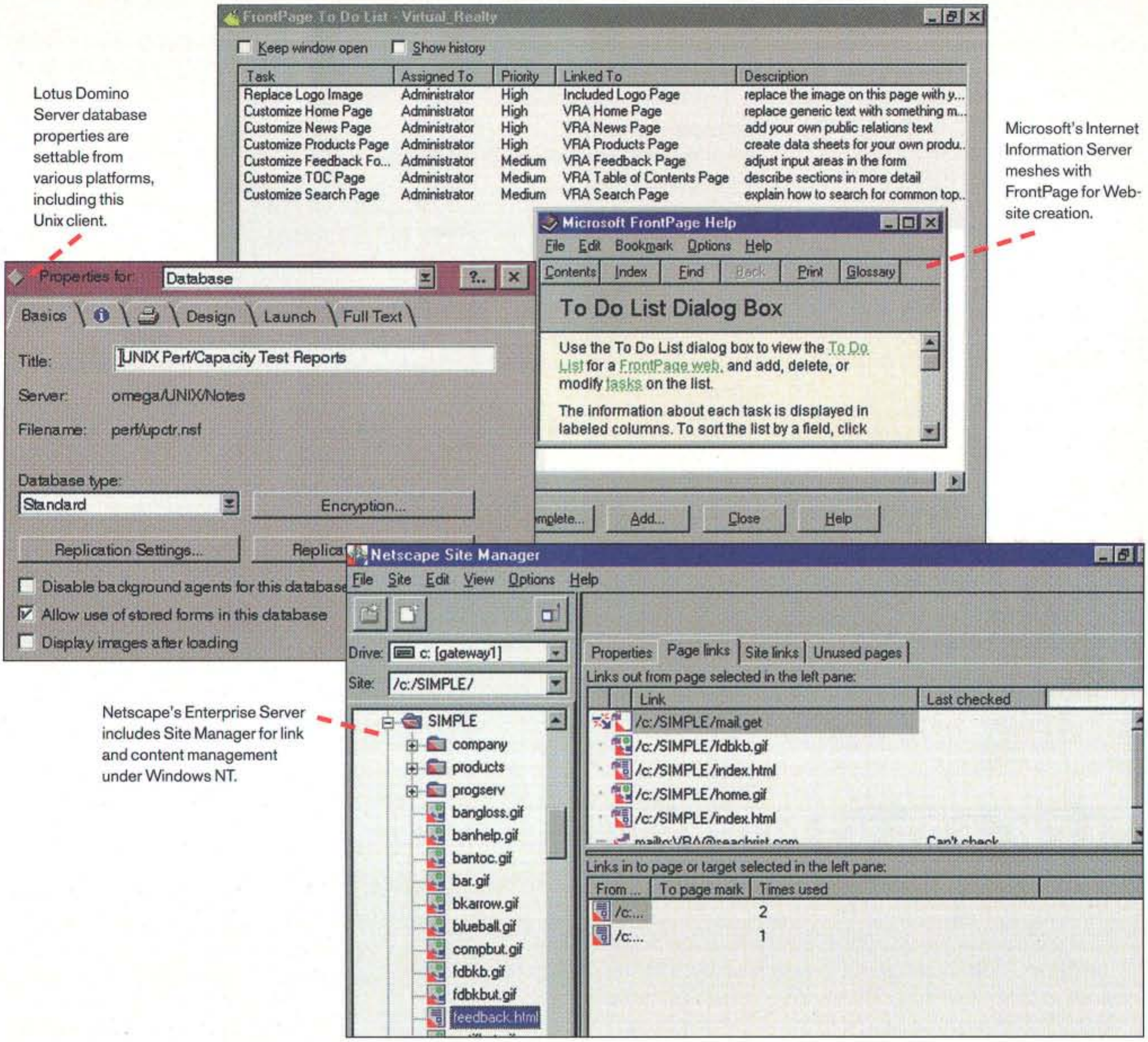
Server vendors are choosing either depth of OS support—like Microsoft, whose IIS runs only on Windows NT 4.0—or breadth of support, as Netscape and Lotus do. Both Enterprise Server and Domino run on various flavors of Unix, as well as NT 3.51 and 4.0; Domino even runs under OS/2.

Performance is obviously an important consideration when you're looking to distribute applications in an enterprise environment. One way to boost performance is to add CPU processing power. While this used to mean upgrading the server CPU to a faster processor, today you can add more processors on an as-needed basis via symmetric multiprocessing (SMP). All these Web servers support SMP, although some machines do it better than others. In addition, pricing is an issue in terms of SMP support. Netscape and Lotus both charge for SMP versions of their products; Microsoft does not.

As Tiers Go By

When a single server handles hundreds or thousands of users, server failure is not an option. But maintaining two or more identical servers solely for backup can be costly. Thus, extending the client/server model to the Internet requires some reworking to make it less costly and more fault tolerant.

By extending the client/server model to a multitiered scenario, you distribute services that were previously handled by only one server to many servers. The


FrontPage To Do List - Virtual_Realty
Microsoft FrontPage Help
File Edit Bookmark Options Help
Contents Index Find Back Print Glossary
Properties for Database
Basics Design Launch Full Text
Encryption...
Replication Settings...
mplete... Add... Close Help
Netscape Site Manager
File Site Edit View Options Help
Properties Page links Site links Unused pages

☐ Keep window open ☐ Show history

Task	Assigned To	Priority	Linked To	Description
Replace Logo Image	Administrator	High	Included Logo Page	replace the image on this page with y...
Customize Home Page	Administrator	High	VRA Home Page	replace generic text with something m...
Customize News Page	Administrator	High	VRA News Page	add your own public relations text
Customize Products Page	Administrator	High	VRA Products Page	create data sheets for your own produ...
Customize Feedback Fo...	Administrator	Medium	VRA Feedback Page	adjust input areas in the form
Customize TOC Page	Administrator	Medium	VRA Table of Contents Page	describe sections in more detail
Customize Search Page	Administrator	Medium	VRA Search Page	explain how to search for common top...

To Do List Dialog Box

Use the To Do List dialog box to view the To Do List for a FrontPage web, and add, delete, or modify tasks on the list.

The information about each task is displayed in labeled columns. To sort the list by a field, click

Title: UNIX Perf/Capacity Test Reports

Server: omega/UNIX/Notes

Filename: perf/upctr.nsf

Database type: Standard

☐ Disable background agents for this databas

☑ Allow use of stored forms in this database

☐ Display images after loading

Drive: c: [gateway1]

Site: /c:/SIMPLE/

- SIMPLE
  - company
  - products
  - progserv
  - bangloss.gif
  - banhelp.gif
  - bantoc.gif
  - bar.gif
  - bkarrow.gif
  - blueball.gif
  - compbut.gif
  - fdbkb.gif
  - fdbkbut.gif
  - feedback.html

Links out from page selected in the left pane:

Link	Last checked
/c:/SIMPLE/mail.get	
/c:/SIMPLE/fdbkb.gif	
/c:/SIMPLE/index.html	
/c:/SIMPLE/home.gif	
/c:/SIMPLE/index.html	
mailto:VRA@searchrist.com	Can't check

Links in to page or target selected in the left pane:

From ...	To page mark	Times used
/c:...		2
/c:...		1

Lotus Domino Server database properties are settable from various platforms, including this Unix client.

Microsoft's Internet Information Server meshes with FrontPage for Web-site creation.

Netscape's Enterprise Server includes Site Manager for link and content management under Windows NT.

The Web applications servers we tested offer a wealth of services on varied platforms.

additional servers are not duplicates of the first, but rather alternate service handlers. A simple example is using one server for database services and another for Web services.

One exciting development resulting from this move to multitiered computing is the concept of *agents,* automated applets governed by business-process rules. In a work-flow model, an agent can be designed to notify a member of a workgroup that a document is ready for his or her review only after another member of the workgroup has finished reviewing it. Events such as document modification and document creation act as triggers to start an agent; the agent then automatically conducts a specified action when the trigger occurs.

Agents are relatively old hat, but creating agents in different programming languages to run on different platforms is new. Domino supports agents in the current version, but not CORBA, while Enterprise Server supports agents in version 3.0. With Microsoft IIS you can write your own agents using embedded Visual Basic commands in an Active Server Page, but as yet there is no agent management functionality as it exists in Lotus Domino Server.

Webifying Apps

All three vendors offer slick applications development tools. Netscape's LiveWire and LiveWire Pro, combined with Netscape Enterprise Server's support for Java and JavaScript, set the stage for the current momentum to turn the Web into the world's largest development platform.

Lotus's dynamic site-creation assistant, Domino.Action, allows you to create sites with business-collaborative environments by merely filling in prompted fields. Web pages that act as white-paper repositories and threaded discussions virtually create themselves. On the downside, however, more complex Domino.Action sites can take a long time to compile. Microsoft's Active Server Pages up the ante on this front by embedding compile-free Visual Basic commands inside HTML tags.

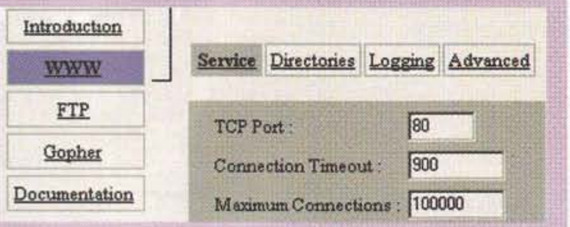
continued

WEB APPLICATIONS SERVERS

BEST OVERALL

Microsoft Internet InformationServer 3.0

Microsoft Internet Information Server edged out the competition this time around.



TCP Port : 80
Connection Timeout : 900
Maximum Connections : 100000

	Lotus Domino Server 4.5a	Microsoft Internet Information Server 3.0	Netscape Enterprise Server (Unix)	Netscape Enterprise Server (Windows NT)
PRICE	$995	Bundled with Windows NT Server ($809)	$1295	$1295
TECHNOLOGY	★★★★	★★★★★	★★★	★★★
IMPLEMENTATION	★★★★	★★★★	★★★	★★★
PERFORMANCE	★★	★★★★★	★★★★★	★★★
EASE OF USE	★★★	★★★	★★	★★
INSTALLATION	★★	★★★	★★★★	★★★★
OVERALL EVALUATION	★★★	★★★★	★★★	★★★

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

Applications require databases, and Web applications are no exception. Netscape's database packaging will soon change, but currently LiveWire Pro (which includes Informix's database server) is a $695 option. IIS requires Microsoft SQL Server (single-server license, $849) to add industrial-strength database services to the Web server. Domino uses Lotus Notes as its database server. Notes is nonrelational but provides a rich content store for unstructured information, such as word processing documents and multimedia files. All the servers we tested connect to traditional databases via ODBC.

Not all data fits into a traditional database, so these servers provide full-text indexing that enables you to retrieve information not easily stored in the orderly row-and-column format of database tables. Such information includes data in press releases and product brochures.

Domino supports the most document formats and optionally allows you to include mail in the search, which can span multiple Notes databases as well. Index Server, which comes bundled with IIS, allows indexed searches of HTML, text, and Microsoft Office documents; you can add other formats with Microsoft's filter Software Development Kit. Enterprise Server currently supports only HTML and text and does not allow index updates based on modified files the way the indexing functions in the other servers do.

All three vendors are producing broadcasting components for the distribution of information in real time and on demand. Microsoft's NetShow offers streaming and on-demand audio and video, as well as file broadcasting using HTTP. It comes bundled with IIS at no extra charge. Lotus's Domino.Broadcast offers distribution of streaming text and OLE objects via PointCast for an additional $1295, with a video service add-on planned for release by the end of the year. Netscape's Media Server currently provides streaming audio.

No Web applications server can be without site-creation and management tools. Lotus's Domino.Action, Microsoft's FrontPage and FrontPage Server extensions, and Netscape's Navigator Gold all create Web sites quickly and simply. While not as graphical as FrontPage, Domino.Action easily sets up collaborative Web environments that support threaded discussions and document libraries.

Lotus Domino Server 4.5a

Multitiered infrastructure and groupware services make Lotus Domino Server an attractive choice for a Web applications server. Domino uses the rich Lotus Notes content data store, provides middleware services to handle file-format incompatibilities, works on multiple platforms, and offers an upgrade path to fault tolerance and load balancing. This rich features base takes its toll on performance, however,

TECH FOCUS OBJECT ARCHITECTURE

The Open Force vs. the Legacy Object

Distributing applications in this age of component software comes down to distributing objects. For object architectures, there are two choices: DCOM and CORBA.

DCOM, Microsoft's Distributed Component Object Model, is built on ActiveX and OLE technologies. DCOM does Windows—NT Server, that is—but not Unix, the historical de facto standard for Internet servers. So far, you're stuck with Microsoft if you want to use DCOM to distribute your applications, but Software AG currently has a product in beta that extends OLE and ActiveX to Unix servers.

Lotus and Netscape take the open road with the Common Object Request Broker Architecture (CORBA), which offers a more complete object architecture than DCOM. Specified by the Object Management Group (OMG), CORBA promises a way to implement objects to be shared across machines, even when those objects run on different OSes.

Netscape plans to offer the JavaScripting of Java, CORBA objects, and support for CORBA services and IIOP when Netscape Enterprise Server 3.0 ships in the second quarter. Lotus is planning on exposing Domino back-end classes via Java this summer and extending this exposure to IIOP by year's end.

CORBA's strong suits are its platform independence and its provision for transaction processing as a part of its specification. DCOM is currently a single-platform solution, and Microsoft's transaction services are built on top of DCOM; it boasts an installed user base of over 50 million and tight integration with the Windows OS.

Netscape is not alone in considering DCOM to be a proprietary architecture, but Microsoft contends that while DCOM is a complete application environment, CORBA is simply a mix of specifications assembled from many software vendors' ideas about how to interpret and implement distributed objects.

If history is any indication, a bridging technology between DCOM and CORBA will evolve, and the debate will subside. For now, expect to hear a lot of noise on each one's benefits.

and not enough of the services support open Internet standards, but Lotus plans to extend Domino's capabilities dramatically in this regard by the end of the year.

Workgroup services include directory, group scheduling, document library, work flow, forum, and news, all of which aid collaboration among a company's employees. Domino offers the greatest support of these functions without add-ons, but taking full advantage of these services now requires a Notes client, such as Notes Desktop ($69 per client). Weblicator, a $29 browser plug-in, replicates site content into a client-side Notes database for offline browsing with some Notes services.

Domino is the only product we tested to extend Microsoft's OLE to Macintosh clients as well as to Windows clients, and it's also the only one to run under OS/2—not surprising, given IBM's ownership of Lotus. Lotus Domino Server is the current hands-down winner for creating and publishing a Web site with real collaborative business-process applications. Domino's rich feature set makes it a less attractive option for simple static content publishing, however.

Microsoft Internet Information Server 3.0

Although IIS lacks the object-store, messaging, and collaborative-computing components that Domino offers out of the box, it's well integrated with the NT Server OS. IIS inherits all the applicable NT OS services, but of course it runs only under NT. But Microsoft is good at diverting attention from IIS's weaknesses by giving away products—and Active Server Pages, Index Server, NetShow, and FrontPage are impressive giveaways. To provide real industrial-strength database services, IIS requires Microsoft SQL server.

In addition to being an impressively bundled package, IIS was the fastest of the servers that we tested. These are two compelling reasons to go where Microsoft wants you to go today.

Netscape Enterprise Server 2.01

Enterprise Server has a lot going for it as a static Web server, but for Web applications you're likely to prefer the new technologies that are coming in version 3.0. The list is long (see the text box "These Servers Missed the Bus" on page 118) and includes improved distributed content management, database support, intelligent

FEATURES

	Lotus Domino 4.5a (Windows NT)	Microsoft IIS 3.0 (Windows NT)	Netscape Enterprise Server 2.01 (Unix)	Netscape Enterprise Server 2.01 (Windows NT)
OSes supported	IBM AIX, IBM OS/2, HP-UX, Sun Solaris, Novell NetWare	NT 4.0	DEC Unix, IBM AIX, SGI Irix, Sun Solaris, HP-UX, Macintosh	NT 4.0, NT 3.51 (also Unix and Macintosh)
Distributed object technology	None	DCOM	CORBA	CORBA
Multiprocessor support cost	$2995	No charge	$5593 and up	$5593 and up
STANDARD SERVICES/COMPONENTS				
Database server	✓	A	A	A
FTP		✓		
Gopher		✓		
SMTP/MIME	✓	A	A	A
POP3		✓	A	A
Streaming audio		✓	A	A
Streaming video		✓		
Directory/address book	✓	A	A	A
Document library services and version control	A	A	✓	✓
Work flow/rules-based actions		✓	A	
SECURITY				
S-HTTP support		✓	✓	✓
SSL support (2.0 and 3.0)	SSL 2.0	✓	✓	✓
Encryption of stored files	Notes			
Digital signatures	Notes	✓	✓	✓
SERVER-ADMINISTRATION FEATURES				
Option for separate virtual server configurations	✓	✓	✓	✓
Configuration rollback			✓	✓
Secure remote administration	✓	✓	✓	✓
DATABASE ACCESS				
Transaction-processing technology		A	A	A
Database server included	✓	A	A	A
Call stored procedures	✓	✓		
Report writer included		✓	A	A
APPLICATIONS DEVELOPMENT				
Server-side Java Virtual Machine support		✓	✓	✓
ActiveX/ActiveX scripting	✓	✓		WinCGI
Compile-free scripting		✓		
CGI and WinCGI	✓	✓	✓	✓
Server-based scripts	✓	✓	✓	✓
ISAPI support		✓		
NSAPI support			✓	✓
VIM support	✓			
FULL-TEXT SEARCHES				
Index proprietary file formats	✓	✓		
Automatic incremental document indexing	✓	✓		
Document-attribute searches (metadata)	✓	✓		
Proximity searches	✓	✓		
CONTENT CREATION AND SITE MANAGEMENT				
Automatic link updates	✓	✓		
Link-integrity checking	✓	✓		

✓ = yes.

Notes = Feature available to Lotus Notes clients.

A = Available in a separately priced add-on or product.

WinCGI = OLE support on Windows clients via WinCGI.

agents, LDAP, and Common Object Request Broker Architecture (CORBA).

All we can say at this point is that Enterprise Server 3.0 looks good on paper. Despite being a bit long in the tooth, Enterprise Server 2.01 performed respectably against its newer competitors.

A Competitive Market

When looking at the Web as a launchpad for multitiered computing, the bad news is this: As of this writing (early April), no one offers a product that addresses all aspects of the obstacles that prevent you from offering Web application services in a robust, transparent, optimized, and cost-effective manner. The good news is that competition is spurring vendors to fill in their technology gaps at a stunning pace. Based on what we've seen in current shipping and beta products, soon companies of all sizes will be able to use Web sites as collaborative computing environments.

Web-based collaborative computing still requires technology and infrastructure enhancements to solve real business problems. However, a highly competitive market should continue to churn out better products at lower prices. **B**

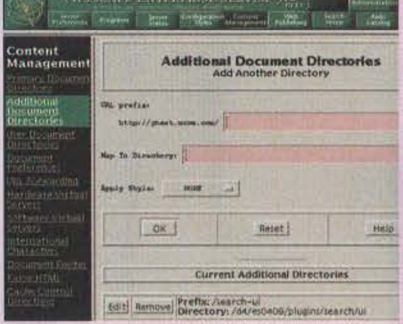
David Seachrist has tested all types of software at NSTL for 10 years. You can contact him at **dseachrist@prodigy.com**. *Stephen Platt is NSTL's director of electronic publications. You can reach him at* **editors@nstl.com**.

These Servers Missed the Bus

Neither Netscape's Enterprise Server 3.0 nor Oracle's WAS 3.0 were quite ready when we did our testing. However, both deserve a look if you're evaluating servers.

Netscape Enterprise Server 3.0

With the release of Enterprise Server 3.0 this spring, Netscape hopes to decentralize Web-site management by shifting the responsibility for content management from the Webmaster to the content originators. The idea is to let users add documents and directories to their site and determine access rights to the content they create from their browsers.


Netscape Enterprise Server 3.0
Content Management
Additional Document Directories
OK
Reset
Help

Additional Document Directories
Add Another Directory
URL prefix:
Map To Directory:
Apply Style: NONE
Current Additional Directories
Prefix: /search-ui
Directory: /d4/es0406/plugins/search/ui

Enterprise Server 3.0 supports remote administration from anywhere.

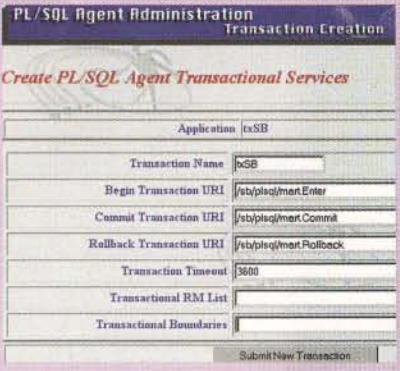
The new release adds full-text search features, such as automatic index updates, allowing immediate search access to newly changed data, and searches by content or by document attributes, such as author, title, and modification date. Rules-based information processing, similar to the work-flow technologies in proprietary groupware packages, will also be added in the form of intelligent agents triggered by specific events.

The LDAP protocol provides an open-directory-service interface for interoperable server management, while new distributed administration features allow synchronized server configuration.

As Internet commerce takes off, stronger database and transaction-processing features are needed. Stored procedures, multiple database connections, and persistent transactions are all features that Enterprise Server 3.0 will support. Native connections with Informix and Oracle databases will be added.

Oracle Web Application Server 3.0

Rather than attempting to enter the highly competitive Web-server market, Web Application Server (WAS) 3.0 builds on Oracle's strength in database technology and transaction processing to provide an infrastructure for delivering transactional applications. WAS 3.0, which ships with a Web server from Spyglass Technologies, works with most other popular Web servers (including IIS and Enterprise Server) and solves the problem of interfacing to legacy applications by isolating applications from the server. This process-isolation model forces each application to run as a separate persistent process instance, while an HTTP dispatch mechanism from the HTTP server provides the glue and plumbing.



Create PL/SQL Agent Transactional Services

Application	txSB
Transaction Name	txSB
Begin Transaction URI	/sb/plsql/mart.Enter
Commit Transaction URI	/sb/plsql/mart.Commit
Rollback Transaction URI	/sb/plsql/mart.Rollback
Transaction Timeout	3600
Transactional RM List	
Transactional Boundaries	

WAS 3.0 uses agents to manage database transactions.

Oracle's technology uses a CORBA-compliant Web object request broker (ORB) and cartridges that can plug into the broker to provide various back-end services to interface with Oracle SQL databases, the Java Virtual Machine, ODBC-compliant databases, and other data sources. Cartridges run independently but can also communicate with applications or with other cartridges without resorting to the HTTP level. Cartridges can also be deployed across servers instead of just on the same server, as is the case with WebServer 2.1, the pre-CORBA version of WAS 3.0.

PRODUCT INFORMATION

Lotus Domino Server 4.5a
$995 (for Windows NT or Unix)
Lotus Development Corp.
Cambridge, MA
800-343-5414
617-577-8500
fax: 617-693-0968
http://www.lotus.com
Enter 1043 on Inquiry Card.

Microsoft Internet Information Server 3.0
bundled with Windows NT Server ($809)
Microsoft Corp.
Redmond, WA
206-882-8080
fax: 206-936-7329
http://www.microsoft.com
Enter 1044 on Inquiry Card.

Netscape Enterprise Server 2.01
$1295 (for Windows NT or Unix)
Netscape Communications Corp.
Mountain View, CA
415-937-2555
fax: 415-528-4140
http://home.netscape.com
Enter 1045 on Inquiry Card.

Web Application Server 3.0
$995 (for Windows NT or Unix)
Oracle Corp.
Redwood Shores, CA
415-506-7000
fax: 415-506-7200
http://www.oracle.com
Enter 1046 on Inquiry Card.

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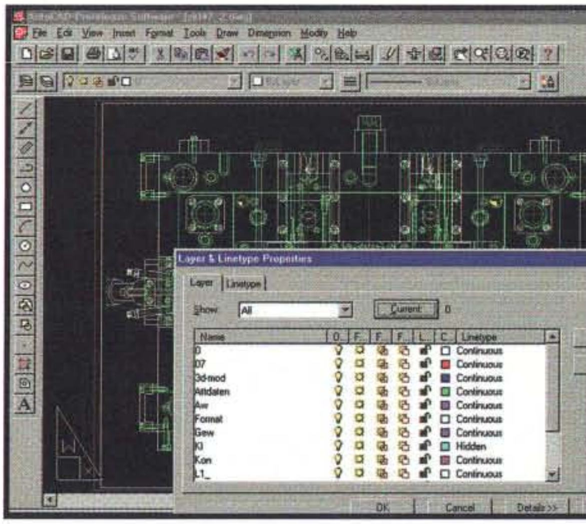
Review

CAD Software

AutoCAD 14 for Windows is as fast as its quickest DOS predecessor and is more productive, too. **By Evan Yares**

Faster on the Draw



Show: All

Current: 0

Name	O	F...	F...	F...	L...	C	Linetype
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07						🟥	Continuous
3d-mod						🟦	Continuous
Altdaten						🟩	Continuous
Aw						🟪	Continuous
Format						☐	Continuous
Gew						🟪	Continuous
Kl						🟦	Hidden
Kon						🟥	Continuous
L1_						☐	Continuous

AutoCAD Release 14
$3570
per seat; upgrades from R13, $495 (requires Windows 95 or NT)

Autodesk
San Rafael, CA

800-964-6432
415-507-5000
fax: 415-446-1919

http://www.autodesk.com/

Enter 985 on Inquiry Card.

With Release 14, AutoCAD has finally taken a giant step into the mainstream Windows world.

AutoCAD may be unique among PC software packages. It's been around 15 years but is still at the top of its product category. It is also, at its core, the same sort of program it was 15 years ago—a heavy-duty drafting tool used mostly by people who make their living with it.

In recent years, Autodesk has been accused of forgetting AutoCAD's heritage. Release 13 (R13), the most recent version, was generally considered a disappointment. It shipped late and suffered from numerous bugs and performance problems. It did little to make day-to-day drafting any easier, and it took more than a year and a half to get to a stable revision.

As a result, many CAD-industry observers, including myself, have questioned whether Autodesk could deliver a release good enough to overcome the bad reputation of R13. I'm pleased to report that Release 14 is possibly the finest new AutoCAD I've ever seen. It's not that this version has some particular killer feature; it's more that Autodesk has really paid attention to the fundamental issues of performance, productivity, and software quality. This release is good enough that users of older versions, even those who've said they wouldn't upgrade, will certainly have to reconsider.

Performance

Release 13 required more computer power than most users had on their desks. Further, it had a big memory footprint and created enormous drawing files. Autodesk has tuned R14 extensively for improved performance. This is no mean feat because there's no single thing you can do in a complex program like AutoCAD to make it faster; performance is the sum of many little things. Autodesk tore out the existing display code and replaced it with a Heidi-based graphics system. The developers reworked complex entities, such as polylines and hatches, that had caused performance problems in the past. They added demand-loading for several program modules. They fine-tuned a number of areas, making many little improvements. The end result is a program that, running under Windows 95 or NT on a Pentium-class machine with 32 MB of RAM, is as fast as AutoCAD R12 running under DOS. Frankly, I never thought Autodesk would be able to pull this off, but my testing confirms that indeed it has.

RATINGS	
TECHNOLOGY	★★★
IMPLEMENTATION	★★★★★
PERFORMANCE	★★★★★

Productivity

It's one thing to make a CAD program that exhibits fast interactive performance. It's something entirely different to make a CAD program, especially one with a long legacy, fundamentally more productive. Release 14 includes a few new tricks that make it easier for the average user to become productive.

My favorite productivity enhancer is the new AutoSnap function, an inference-based object-snapping system. Translation: It tracks objects under the cursor and finds points of geometric interest without requiring operator intervention. For example, if you move the cursor over a line, AutoCAD will place a marker icon over the endpoint or midpoint (depending on where your cursor is). Since most drafting is done with reference to such points of geometric interest (endpoints, midpoints, centers, etc.), this can be a major time-saver.

This feature, while new to AutoCAD, has been available from competitors for quite some time. Ashlar made the technology popular in its Vellum product in the late 1980s. I suspect that long-time AutoCAD users will wonder how they got along without this feature. (They may

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

also wonder why it took so long for Autodesk to include it in AutoCAD, but that's another story.)

A more subtle productivity enhancer is the move to dialog boxes built on the Microsoft Foundation Classes (MFC) library. Autodesk has for years gone its own way in interface issues. But R14 (which runs only under Windows 95 or NT) is about as Microsoft-compatible as a program gets. This change makes AutoCAD more familiar for those who are used to Windows-based programs, and that could translate into a nice boost in overall user productivity.

MFC also helps improve AutoCAD's API. AutoCAD has always been a developer's CAD system, with third parties supplying a wide range of vertical add-ons. The new MFC-compliant ObjectARX API (see the Tech Focus below) offers developers better control and capabilities than they've ever had. R14 also supports ActiveX Automation (formerly called OLE Automation), which will allow users skilled in Visual Basic or Visual Basic for Applications to customize AutoCAD. In fact, ActiveX Automation is very fast and does most of what ObjectARX does, the major exception being that there's no provision for creating custom objects.

One area of productivity that's often ignored is printing. CAD programs are different from general applications in that they generally drive large plotters and have exacting requirements for quality. In R14, Autodesk has improved printing in at least three distinct ways. First, R14's new internal printer drivers handle OLE objects. By using these drivers, instead of the standard Windows system printer drivers, you get better performance and finer control over output quality. Second, R14 now works properly with networked printers, with no fiddling required. And third, R14 comes with a batch printing program, so you can send an entire job out in one fell swoop.

There is also an advanced batch plotting program included as a bonus on the R14 CD. It adds control over which layers and area of a drawing will get plotted, and it incorporates a plot stamp function, which prints user information at the edge of the drawing. This advanced version is also able to do a "plot test" of a batch list of drawings to determine if any parts of any drawings are invalid or missing without actually doing a hard-copy plot; this can be a real time saver.

Quality

Autodesk got a big black eye with R13's quality problems. The company eventually fixed those problems, but it's determined not to repeat history with R14. This review is based on a beta version of R14 that is quite stable. It isn't perfect, but the bugs I've discovered are mostly functional failures—things that are straightforward to track down and fix—rather than nasty blue-screen crashes that defy easy solution. Moreover, at the time we were testing the product, Autodesk had not announced a ship date for R14, instead indicating that it would ship the program when the software is actually ready. (And by press time, Autodesk had made the new version available.)

We all know, though, that bugs are a fact of life. One of the questions yet to be answered is how well Autodesk will respond in fixing them. One step the company has taken is to institute a paid update subscription service, although it remains to be seen whether updates will be available separately.

It's Still AutoCAD

AutoCAD R14 isn't a breakthrough product—it's just a cleaner, faster, more productive version of what Autodesk has been selling for 15 years. It's still expensive. There's lots more to R14 than I've covered here, including improved rendering, better OLE object support, and more powerful printer drivers. And there are also some things that are not as well resolved as they could be (for example, block names over 32 characters or with spaces are not permitted).

Nonetheless, Release 14 represents a small step for CAD, a giant step for Autodesk. The company is now perhaps 80 percent of the way through the process of taking a 15-year-old CAD program and making it ready for the 21st century. There's still work to be done, but Release 14 proves beyond a doubt that Autodesk can and will do it.

Evan Yares teaches and writes about CAD software. You can reach him at **evan-yares@design-automation.com.**

TECH FOCUS OBJECTS

Dead Objects, Zombies, and Proxies

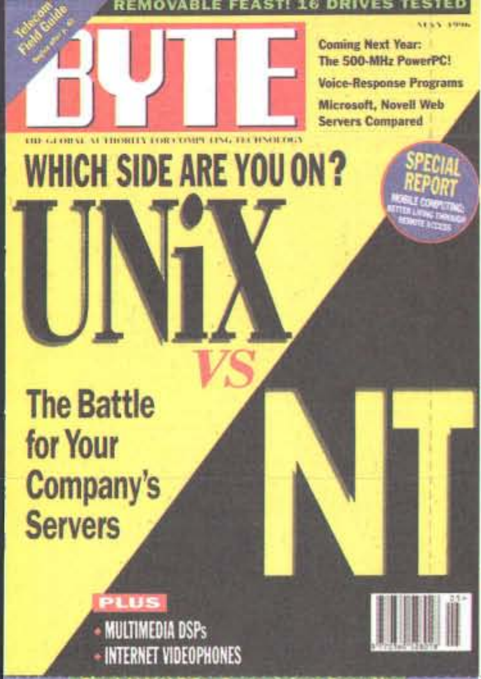
CAD, by its very nature, is well suited to the use of objects. After all, why draw lines when you can draw walls? And why use dumb symbols when you can use smart objects? Think about it: A door object can be smart enough to know it goes in a wall instead of in the middle of a room.

AutoCAD's new object architecture promises smarter applications for a variety of disciplines, including architecture, facility management, civil engineering, mechanical engineering, numerical control, and more. The common bond between these applications will be AutoCAD's most powerful API language—ObjectARX. ARX (AutoCAD Runtime eXtension) is a fully featured C++ API. The version that ships with R14 supports Microsoft Foundation Classes (MFC), making interface issues much easier to deal with. ObjectARX also allows developers to create their own object types—a capability that could be a double-edged sword.

In order to prevent an all-out object war—imagine if a door from one developer didn't recognize a wall from another—Autodesk has been working with a number of developers to create industry foundation classes (IFC) for CAD objects. The aim is that if a developer's applications are IFC-compliant, there's a good chance that they'll play nicely with other IFC-compliant applications.

One of the more interesting side effects of AutoCAD objects created by a third-party program is that they might not be useful when that third-party program isn't loaded. These objects will show up on the screen, and be printable, but they might not be editable. The third-party developer has the option of allowing the user to explode the custom objects (i.e., break them up into their constituent geometry) but is not absolutely required to provide this functionality. Because these uneditable objects look alive but act dead, they're called "zombies." Autodesk, understandably enough, prefers to call them "proxies."

Here's the bottom line: If you're a serious CAD user, you'll get a lot of benefit from the new generation of ObjectARX-based applications for AutoCAD R14. Just be sure to ask ahead of time if an application is IFC-compliant, and whether objects created by it can be exploded when the application is not loaded.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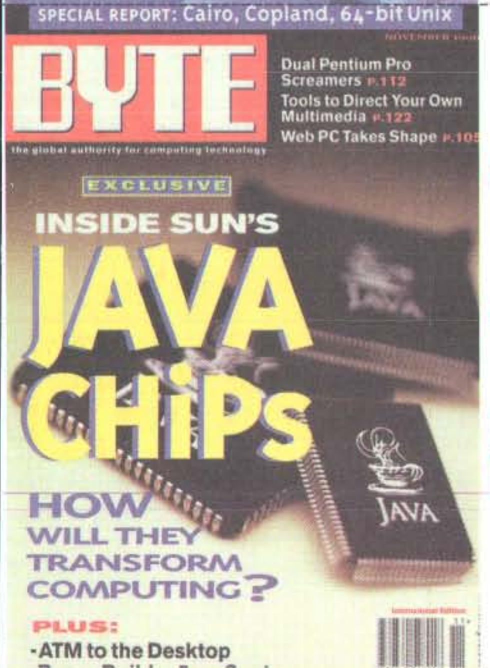
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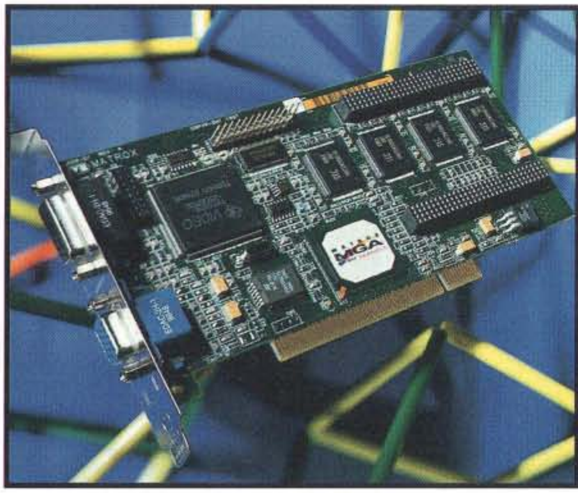
Review

Graphics Accelerator

Although it has a few limitations, Matrox's Millennium II offers a jump to 16 MB at a price that means business. ***By David Em***

Dawn of the New Millennium



Millennium II
$299
(for Windows NT 4.0
and Windows 95)

Matrox Graphics, Inc.
Dorval, Quebec, Canada

800-361-1408
514-969-6320

http://www.matrox.com

Enter 1006
on Inquiry Card.

Despite its small, 3½- by 7-inch footprint, the Millennium II is still large enough to accommodate Matrox's MGA-2164W engine.

Rather than having to mortgage your house so you can afford to do CAD, desktop publishing, and 3-D design on your Windows NT machine, you can use Matrox Graphics' new Millennium II 64-bit MGA graphics accelerator, which offers a price/performance breakthrough. For just a fraction of the cost of a proprietary Silicon Graphics workstation or a high-end solution, such as Intergraph's RealiZm 3D, the new Millennium allows standard PCs running NT to effectively handle high-end rendering and design.

The PCI board comes in a $299 4-MB base configuration that's upgradable to 8, 12, or 16 MB of dual-ported Window RAM (WRAM) memory. The 8-MB version outputs 24-bit, 1280- by 1024-pixel resolution at 85 Hz, and up to 1800 by 1440 pixels in 16-bit color at 70 Hz. A 250-MHz RAMDAC provides flicker-free refresh rates at most resolutions and color rates.

At the heart of the Millennium II is Matrox's new MGA-2164W processing engine. The 2164W features faster 2-D performance and 3-D Gouraud shading through the use of full scatter/gather PCI bus mastering, which enables the graphics accelerator to process rendering commands and geometry calculations in parallel with the CPU. The engine also does both *x* and *y* full-screen video interpolation, which lets it retain full-screen quality when scaling to high resolutions.

RATINGS	
TECHNOLOGY	★ ★ ★ ★ ★
IMPLEMENTATION	★ ★ ★
PERFORMANCE	★ ★ ★ ★

I tested the 8-MB card on a Dell 200-MHz Pentium Pro outfitted with 32 MB of RAM. Once it's installed, the Millennium II's Monitor Control Panel lists over 250 specific monitor profiles to choose from. It recognized my NEC MultiSync XP21 right off the bat, but there was no profile in the database for my ultrahigh-resolution ViewSonic P815 monitor.

As a result, the P815's resolution capabilities were not immediately accessible when I connected it. I ran the card at 1280 by 1024 pixels in 24-bit color at a rock-solid refresh rate of 85 Hz, but when I tried for 1600 by 1200, the card bumped down to an unacceptable 60 Hz. After a half hour of poking around the Monitor Control Panel's deep, yet unintuitive, tweaking features, I called a Matrox technician for help. A full hour later, I finally reset the refresh rates correctly.

I had excellent results working with a variety of 2-D Windows paint and image-processing applications, including Fractal Design's Painter 4.0, Adobe Photoshop 4.0, and Macromedia's xRes 3. Screen-refresh rates and updates were exceptionally fast and hassle-free at 1280 by 1024 in 24-bit color. However, at 1600 by 1200 with 24-bit color, the 72-Hz flicker rate becomes noticeable.

I tested double-buffered 3-D performance with Kinetix 3D Studio Max. Here the card generated perspective-correct 3-D texture mapping with a 32-bit z-buffer. Accordingly, I had good results with rapid updates for wireframe, shaded, and textured preview ports. I saw a few artifacts on rapid screen redraws, but they were minor. Matrox includes AutoCAD, Direct3D, and Heidi drivers, and OpenGL support is currently under development.

The Millennium II's video engine plays back full-motion, full-screen video with DirectDraw, Direct3D, DirectVideo, and ActiveMovie support.

Power 3-D users doing highly intensive geometric calculations might opt for costly board solutions, such as the Oxygen 402 from Dynamic Pictures and Intergraph's RealiZm 3D. But the Millennium II remains a solid, all-in-one solution for cost-conscious midrange 3-D users, as well as 2-D users at all levels. **B**

David Em (Sierra Madre, CA) is a digital artist and writer. You can contact him at **davidem@earthlink.net.**

PHOTOGRAPH: DARYL SOLOMON © 1997

This network OS turns Java into a full-service intranet platform. ***By Peter Wayner***

Novera Composes Epic for Java

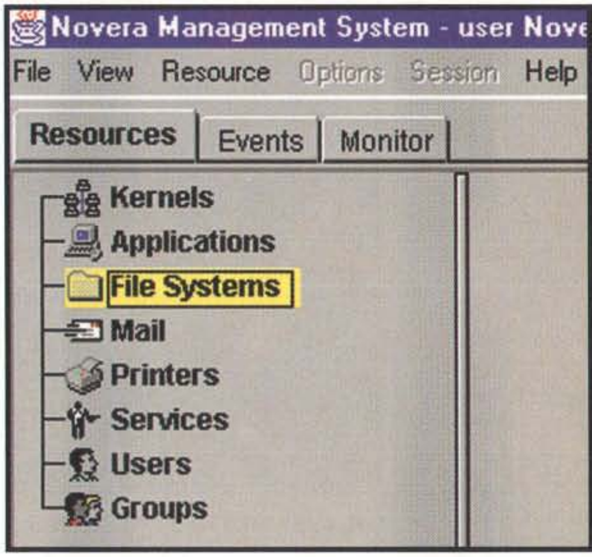
Java's first wave produced applets that were largely just gimmicks for Web-page designers who wanted to add a dancing widget to their page. Little more was possible because a Web browser running Java will let the applet only draw to the screen and open windows. Really useful functions (e.g., saving files, printing, or accessing the Internet) were deliberately kept out of the reach of the Java applet to prevent malevolent or just plain buggy functions from trashing a host.

The second wave of functioning applications is almost here, thanks to Novera's Epic, a Java-based network OS (NOS) enhancement for corporate intranets. Epic is a layer that offers all the missing resources to applets running on a corporation's network clients. People can edit documents, add data from remote files, and print the final version, all from a browser still playing in the Java sandbox.

The system is not magic. You must install Epic on the same system as the HTTP server, and it requires access to an LDAP server through the network. It runs as a separate process on the HTTP server, sending out the applets to the client browsers on the network. Most browsers let applets running in the browser's own sandbox communicate with the applet's originating host. This is how you access network resources. The data travels to the HTTP server, which sends it to the right file server, printer, or other resource.

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★★

The software is a crucial step toward enabling network computers (NCs), such as the ones from Oracle. In this realm, a user would need only a "thin" client running a Java-enabled Web browser such as Netscape Navigator 3.0. Corel is using Epic's layer to enable its applets to provide all necessary services on the Internet. Corel's suite of office applications will live as Java applets on an HTTP server in the office. A Java "kernel" from Novera will run on the same machine and provide the file and printing services.



Epic 1.1
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(Windows NT or Unix, HTTP and LDAP servers)

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Burlington, MA

617-270-4422
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With Epic, system managers can control access to resources such as printers or the file system, all from a remote browser.

At first glance, this approach sounds unwieldy. If you are running a word processor, your Java applet must connect remotely with Novera's kernel to save a copy of the file. However, this is not too different from what happens already when people save documents on a file server. It is also substantially more secure, because the client's browser treats the Java applet as untrusted code.

This extra layer of security can be useful in a corporate environment. For instance, Novera is also shipping a Java application for reading e-mail. You could use this tool to read your e-mail from any Java-capable browser that may be in a cybercafe, a bar, or an airport. The Epic kernel formats the e-mail data as a Java applet or HTML that is read directly from the distant browser. This client flexibility applies to all applications that are cooperating with the Epic kernel on an HTTP server.

There are limitations to this worldwide flexibility, however. The server dispensing the HTTP and Epic kernel data must be able to send its data without being impeded by a firewall. You can accomplish this by either reprogramming the firewall to let some packets through or locating the server outside the firewall. In many cases, the reprogramming is already in place, because many companies let HTTP requests through the firewall to run Web servers inside the secure perimeter.

Internetwork Services

If you use Epic in your office system, you must create two types of Java programs. The first type is the applets that

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

do the work for you. These all come from the Java applet class and can make contact only with the host machine that gave them up. The second type consists of full-fledged applications written in Java. These provide the "services" or resources that the client applets need.

Novera has included all the major services in release 1.1, available for $7500. These services include Java applications for the expected file access, printing, and mail. Lower-level services include event swapping, time synchronization, and TCP/IP relaying of packets. You control access to these services, and those you write, by a management-and-lock service that controls who uses which applet when. Software developers can use this service to control the licenses for networks.

Epic also includes process management services that let you, for example, pass off work from the HTTP server to other servers with the message-passing services. You can use this to do heavy-duty database access or merely to balance the load on the HTTP server. Novera has clearly considered the needs of corporate IS managers.

Most IS managers will want to develop custom services for their in-house network. Novera ships two sets of skeleton classes. One offers the basic proxy communications that applets use and includes basic methods for creating connections with services running on the HTTP server. The other offers the basic methods for the application running as a service and accepts communications packets from the clients. You can use both class skeletons to whip up services quickly.

You may wonder why you need Novera's system. After all, you can use any Java development kit to write applets that communicate with the host on any port, and plenty of books show how to make your applet invoke its own HTTP or FTP sessions. One of the simplest methods is to write server applications as Common Gateway Interface (CGI) processors and have the applet communicate with them by passing the data as forms objects.

Writing your own CGI scripts and applets might produce most of the same functionality as Epic's clients and services, but it would miss some of the ancillary services. Most programmers using Epic could easily add the buffering and other basic network management to their applets quickly. However, they would be hard-pressed to add extra features such as file management, access control, license management, and remote-server process initiation. When you add this to the built-in e-mail and database access, it is obvious that Novera's package is a good way to get a full office system up and running faster.

The Epic Saga

Adding resources such as printing and file management to a network of Java applets is a crucial step in the evolution of Java from a neat toy to a full-fledged environment. Epic provides an excellent set of features that many IS managers need to build a complete IS system for an office complex. The product should shine in environments where people need to get access to their office system from randomly placed, publicly accessible browsers in places such as airports. Java's security mechanism lets a distant browser act as a full-fledged, trusted terminal.

The OS will also shine in environments where many people use the same software. Centralized servers can control the software and prevent people from mucking up their own installation. On the other hand, offices with highly specialized machines (e.g., programming shops) may find themselves less interested in the highly centralized approach. Anyone who needs customization needs help from the system administrator.

Sun will also soon release a Java OS—a stand-alone OS that can run on different platforms and will compete with the Epic solution. However, Epic will be preferable because it can run directly on top of Microsoft's Windows NT server software and leverage available NT services. A business can still run Microsoft-compatible software while using Epic for major applications, but enabling robust transactional applications may call for a significant investment in Microsoft products.

An interesting academic question is whether an office with a Novera network has a mainframe or a network of PCs. The latter collection may be tied together by a central server that controls which software you can run and exerts control over how it is run, making it like a mainframe. However, most of the Java computation is done on the local machine, meaning that people do not share computational resources too much. In fact, the central server can crash and come up again without disturbing many users. This makes it more like a network of PCs.

The result is a strange hybrid that may have many of the best features of both. Regardless of which perspective you apply, Epic is a neat idea. B

Peter Wayner is a BYTE consulting editor who lives in Baltimore. His latest book is Digital Copyright Protection *(AP Professional, 1997). His home page is at* **http://www.access.digex.net/~pcw/pcwpage.html.**

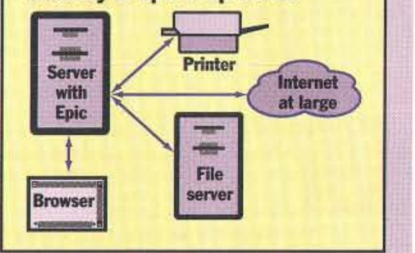
Epic's Centralized Applet Security

The original Java security model that browsers like Netscape Navigator and Microsoft Internet Explorer used was simple: Applets could communicate only with the HTTP server that offered them to the world. That limitation made it essential to have a remote resource manager such as Novera's Epic if the applets were ever going to do much.

Another approach is to relax the security model at the browser. Netscape and Microsoft have examined ways of letting the browser have various shades of network access. For instance, the browser may be able to send mail to any machine on the network, but do FTP only with its host. The user would be able to change the security setup checkboxes to give access to these applets as they choose.

The danger with this method, of course, is that it is too general. One applet may ask you to turn on networkwide mail access for a legitimate reason, but another applet could then turn around and send fake e-mail from your machine while animating some scene in the browser. This possibility makes Novera's centralized security mechanism a necessity.

Security of Epic Proportions



Java applets rely on the originating server for network services.

Review

Operating Systems

Caldera's OpenLinux Base can be a pretty nice first Linux, but it's still not for beginners. By Tom Yager

Making Linux More Livable

Linux might be considered Unix-for-geeks-with-PCs, but it has suffered from Unix's traditional obscurities and drawbacks. And if you don't already know this popular OS and aren't keen on spending several days learning about it, Linux can be a bit frightening. But the trouble people have with Linux has little to do with the software itself; Linux is as sturdy an OS as you'll find anywhere, provided you stick with well-tested versions and keep your patches current.

Caldera is one of a small number of companies (Red Hat being about as well known) that are attempting to package Linux for the masses. Caldera's packaged Linux distributions, all of which are enhanced with commercial software, sell under the OpenLinux banner.

The company plans to offer four levels: Lite (freeware), Base, Standard (for Internet/intranet servers), and Deluxe, a complete application server solution. For this review, only OpenLinux Base 1.0 was available, although at press time Caldera announced that Base 1.1 and Standard 1.1 versions were shipping.

The OpenLinux Base CD is bootable, which makes OpenLinux installation a snap if your BIOS supports it. My test system had an Adaptec 2940 SCSI controller, which recognized the CD and had Linux fully booted in approximately 15 seconds.

RATINGS	
TECHNOLOGY	★★★
IMPLEMENTATION	★★★★
PERFORMANCE	★★★

Installation of OpenLinux Base is easier than for any other Linux I've used. There are still minefields for the uninitiated, however. It gave me some trouble over my system's mix of integrated development environment (IDE) and SCSI controllers, for instance. Hardware probes try to find all your installed devices. But if they fail to find everything, you have to kick off more-detailed probes, a feature that is poorly documented in the manual. Finally, hard-disk-partitioning software can be rough; OpenLinux Base would benefit from an automatic-default layout and a friendlier partitioning tool.

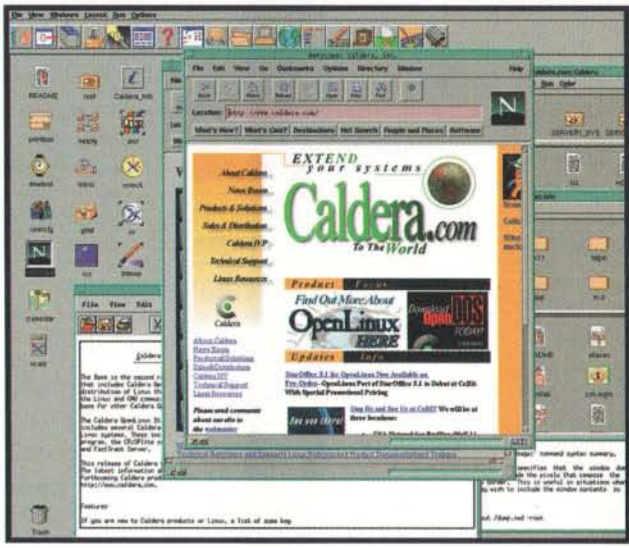
Once it's running, OpenLinux Base includes some marvelous commercial features; the Visix LookingGlass graphical desktop, the Metro-X X Window System server from Metrowerks, the CrispLite editor, and a licensed copy of Netscape Navigator 2.02 are all standard. Caldera has also licensed software from Linux System Technologies that eases installation and administration. These enhancements give OpenLinux Base a slicker, more professional feel than some of its competitors.

OpenLinux Base performed reasonably well in my tests. The LookingGlass graphical shell relies too heavily on unlabeled icons, forcing you to look up their meanings. The small manual looks nicer than most Linux books, but it lacks the material new users need to make a comfortable start. And technical information can be a little hard to find on Caldera's Web site.

At $59, OpenLinux Base qualifies as an impulse buy. Its commercial enhancements make it an excellent place to begin using and learning Linux. Caldera ships only one CD-ROM, so you might also want one of the many inexpensive, multidisc Linux distributions to round out your software library.

New Linux users will find OpenLinux Base friendlier than other Linux distributions. However, you'll still need plenty of time and some good third-party documentation. It wouldn't hurt to have a geek handy, either. **B**

Tom Yager is a freelance writer in north Texas. You can reach him at **tyager@maxx.net**.



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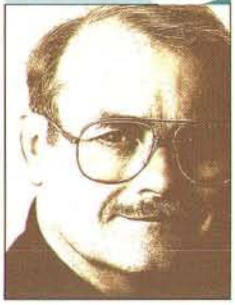
Jerry Pournelle

Chaos Manor



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A Web Site for Chaos Manor

Jerry finally puts Chaos Manor on the Web—and finds time to give Pentafluge an OverDrive upgrade.

It has been a busy month around Chaos Manor. I suppose the biggest news—the latest anyway—is that I managed to design and build Web sites for myself and Mrs. Pournelle. They're not very fancy just now, but by the time you read this, they will be improved. Roberta's site is at http://home.earthlink.net/~rjp. That won't work if you inadvertently add www to the address. Mine is the same except it's ~jerryp. We will probably change those addresses, but if we do, we'll leave a link behind.

I said I managed to design and build those sites, but that's not strictly true. Roberta did most of the conceptual design of her site, and when it came time to implement it, I had several hours' assistance from our artist associate David Em.

We tried a large number of tools, including FrontPage 97 and PageMaker. In fact, the first page we put up was PageMaker output; but we found that for the rather simple stuff we were doing, Microsoft Word in Office 97 turns out to be the best tool for the job. Once David and I got Roberta's page up, I did mine after he left. It's not all that difficult once you know how.

Roberta has done most of her program building with a Mac, and most of the art that's associated with her reading program is in Mac format. When I was building our Web pages, one of my biggest problems was converting Mac image files to a format that Windows would understand. One can put this problem squarely on Microsoft's doorstep: a little bit more intelligence about file-format recognition could have been built into Windows, but it wasn't, and the result can be sheer hell for people who don't have a lot of experience with the problem.

If you save Mac files on a PC-DOS-formatted disk, a PC can see the files, but it won't necessarily recognize them as image files or be able to do anything with them. They need to be converted. If you intend to put up the images on a Web page, in practice you need one of three formats: GIF, JPG, or BMP. A number of programs will read one format and output one of those three.

Quarterdeck's HiJaak Pro, would seem to be ideal: it says it will read just about any image-file format and, once it has done that, export it in any other. The problem with HiJaak Pro is that you must know what image-file format you started with; worse, so far as I can tell, that file has to have the proper file extension for that format. If you don't know what format the file is in or what extension normally goes with that format, you're just out of luck. At least, I was.

One can put this problem squarely on Microsoft's doorstep.

CorelDraw is a bit better at trying to read files in unknown formats. Adobe Photoshop is better still. When Equilibrium Technologies' DeBabelizer was exclusively a Mac program, it was famous for being able to find and convert image files; we'll be testing the Windows version's ability this month. We'll also have a hard look at all the alternatives.

So far, Photoshop has been the most useful program. With its Open As command, you can search through an entire directory of files to see if there are any in a specified format. If it finds one, it will open it without regard to the file extension. Once that's done, you can crop, edit, change file formats, and export it as anything you like.

Since Photoshop recognizes a large number of file formats, it may take you a while to try them all; but the good news is that if what you're after is genuinely an image file, Photoshop will probably find a way to open it. David Em reports that it's tedious, but he's never yet failed to get Photoshop to bring in at least part of an image.

Since Photoshop is also the proper tool for 2-D graphics manipulation, this is another clear win for that program.

CorelDraw isn't quite so good at reading odd files, but once you have them in CorelDraw, manipulation is pretty straightforward. I've been using it in conjunction with my effort to convert Roberta's reading-instruction program from the Mac to Windows Visual Basic. I find that once you get over the initial learning hurdles, CorelDraw and Visual Basic do work well together.

One of CorelDraw's real strengths is an enormous collection of royalty-free images: clip art; photographs of people, places, and things; backgrounds; textures; theme art, both photographs and drawings. Just about any visual image you could want is in one or another of the Corel art and photo collections, at least one of which has more than 20,000 images on 200 CD-ROMs.

Once again, there are some odd hurdles to learning how to find, export, edit, and convert the image you're looking for. Corel has been at this so long that not all the collections are in the same formats or can be read by the same image-browsing

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program. Persistence pays, however. For my purposes, CorelDraw augmented by some of the art collections is the single most useful graphics program I have.

OFFICE 97 IS HUGE, AND SOME PEOple have had problems with it, but it was a lifesaver for building Web pages. Roberta had a graphics image in Mac format. Converting that took some time, and incorporating it into her page was simplified by using PageMaker. Even then, we ended up using Office 97 for the final product.

I started with a number of Word documents on various subjects to be turned into HTML. Several had footnotes. HTML does not support footnotes, so they had to be converted to hyperlinks. Other documents needed some terms explained for a general audience. Again, this was a good use of hyperlinks, which are actually better than footnotes. I have several HTML books, but the thought of inserting all the little HTML symbols by hand was daunting.

Office 97 is huge, but it was a lifesaver for building Web pages.

I didn't have to do that. Word 97 understands Web pages very well. With Word 97, you open a new HTML document, insert a Word document file, and you're halfway there. The footnotes don't come through properly. They're in there, and Word 97 has a neat feature that shows the footnote when you put the cursor on the footnote number in the main text. However, the HTML document format won't let you View Footnotes, or wouldn't for me.

What I did was open the original copy as a Word document, copy the footnotes, and paste them into the HTML copy. Now give each footnote a bookmark (Insert Bookmark; easiest thing in the world) and hyperlink to the footnote. When you insert a hyperlink, Word 97 gives you the choice of linking to a bookmark, a file, or a Web site. It's all quite intuitive. Then I went through the text, found the concepts and words that needed explanation, wrote definitions and such as needed, bookmarked them, and created more hyperlinks. In an hour, I had several of my articles and position papers on space policy up on the Web.

For the record, what I used is available to any EarthLink user: you get 2 MB of Web-page space as part of your basic subscription. To use it, download FTP or learn to use the one in your browser. I find that the FTP given away on EarthLink works well. Then name your home Web page INDEX.HTML; and use FTP to upload the index page and all subsidiary pages to your Web site. It takes about as long to describe it as to do it, once you have the pages in HTML and can read them properly off-line with your Web browser.

One caution: subsidiary files include not only any graphics files you've inserted, but graphics files Word calls on for bullets, lines, etc. When you use Word to make a fancy line or bullet, it's actually inserting a graphics file. Word then saves that graphics file (with the extension .gif) in the same directory that you save the HTML file in.

Second caution: many Web systems are very case-sensitive with filenames. If you insert the file jp.jpg into your HTML document when the file is really named JP.JPG or JP.jpg, your browser may well find it when viewing it off-line, and yet fail to do so when viewing it on the Web site.

The remedy is to rename the Web-site JPG file properly. Unfortunately, that can be exceedingly hard to do. Windows 95 (Win 95) is rather stupid about renaming filenames, and all my attempts to rename jp.jpg as JP.JPG completely failed; yet Word 97 inserted JP.JPG as the filename even though I did Browse and clicked on it. In desperation, I changed to HTML Source in Word 97, found the filename, and manually changed it to jp.jpg. That worked, but it's pretty stupid to have to do it that way. Incidentally, no book I have addresses this problem.

Office 97 is big enough to deserve the name bloatware, and some readers have reported bugs. For instance, Word 97 does not seem to be able to convert long (greater than 1 MB) files from WordPerfect formats. I haven't explored the new features in the non-Word parts of Office 97. For that matter, I can't think of much that I want done that Word 97 does and that Word 7 in Office 95 doesn't do to ordinary documents; but when it comes to Web-page preparation, Word 97 is the bee's knees.

ACTUALLY, I'D INTENDED TO DO MORE with Office 97 for this month's column. I'm on the road—literally, with Roberta driving while I type this. We've just come from a Computer Users in Education meeting in Sacramento, and the Windows Hardware Engineering Conference (WinHEC) starts tomorrow and runs through my column deadline. Thus, I'm working with the Nimantics Orion 8× portable. I've plugged its power converter into one of those gadgets that delivers 110-V power from the car's cigarette lighter, and it's working splendidly. (For more on the Nimantics Orion 8×, see my previous columns in BYTE and on the BYTE Web site.)

The Orion 8× has a 200-MHz Pentium processor, plenty fast enough to run Office 97, and it has an eight-speed CD-ROM drive. It didn't have Office 97. I was in a hurry to get out of the house and didn't see my regular Office 97 CD, so I grabbed a previously uninstalled Microsoft Office 97 Preview program. This says on the disc that it's licensed to one computer for a limited time only, after which you have to install the regular edition. Fine, thought I. It will be on only this one computer, and I need it for only a week.

Yesterday morning I installed it. The installation took half an hour; Office 97 is *big*. I very carefully told it *not* to disturb any previous programs—such as Office 95—and to put itself into a separate directory. It told me I had to close the Office 95 toolbar, which I did, after which it trundled along and announced that installation was successful. Now I rebooted.

After I stopped growling, I fished the useless thing out of the wastebasket.

First thing I saw was a message: "Your copy of Fast Find has expired." This was a bit frightening. Then I tried to open Word. "Your copy of Microsoft Word has expired." I tried to open Word 7. "Incompatible versions, please drop dead, OK?" (Well, it didn't quite say that, but that's what it meant.) At this point, I was in a near panic. I have a lot of work to do, and I can't work without a word processor. Worse, I had started this column and had maybe a thousand words done, and I'd hate to recreate all that in Q&A Write.

Office 97 was filling my laptop's hard drive to no purpose and seemed to be preventing access to Word 7. Time to uninstall. Control panel, Install/Remove Programs. I was pleased to see that Office 95 was still listed in the registry as Microsoft Office, and Office 97 had a separate listing. Uninstall Office 97.

Insert your installation CD.

After I stopped growling, I fished the useless thing out of the motel wastebasket. Fortunately, I hadn't broken it and danced on the bits. Sure, the label warned that it would work for only a limited time, but that led me to believe it would work for only a week, or a month, not that it expired on a certain date. Why not print the expiration date on the label? Or at least have the installation program check the expiration date before wasting half an hour copying files.

The uninstallation was complicated, with confusing messages, and it wasn't complete. A remnant of the useless Fast Find was left in my Startup folder. Worse though, all traces of shortcuts to Office 95

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were gone. There wasn't any way to start Word 7. I spelunked through the directories and eventually found the Office 95 toolbar. Double-clicking on it got me a way to start Word 7, and that's what I am using to write this, so it all ended well barring a near cardiac from fear and rage.

It all ended well barring a near cardiac from fear and rage.

There are several morals to this story. The first, for me, was a resolution never again to install a Microsoft Preview program. Second, if you do install Office 97, in any version whatever, *keep the CD*, because you may never be able to remove it without that CD. Third, Microsoft has gotten so big that it can put out a Preview that will install itself without checking first to see if it has expired. The message here is that Microsoft's time is worth more than yours. As Roberta observes, no start-up company could get away with being that arrogant.

And having said all that, I must report that when I got to WinHEC and told that story, I didn't find a single Microsoft person who wasn't horrified at the problems I'd had. The manager of Microsoft installation programs turns out to be not only a nice chap but someone genuinely concerned about making things better—he was hired precisely because he did not come from inside Microsoft. When he heard about this, he came to tell me he could very well understand that I was angry because it looked like the kind of thing any darn fool would check, but they hadn't. It will be fixed in the future. So I was promised, and in fact I believe it.

I'll get to the other "features" in Office 97 when I get home; this will be on the wire very quickly after I reach Chaos Manor.

THE BUZZPHRASE AT WINHEC WAS "compelling rich interactive user experience," which is the new goal for hardware and software vendors alike. Sometimes that happens in real life, although it's not usual at Chaos Manor.

Pentafluge is one of the oldest 60-MHz Pentium-based systems. It was built by myself (a little) and Larry Aldridge of PC Power & Cooling (a lot) from a Micronics Computers M5Pi motherboard, a DPT SmartCache III controller, a Western Digital Caviar 4-GB hard drive, a Maxoptix T3-1300 optical drive, and a Plextor/Texel Double Speed Plus CD-ROM drive. The last three are SCSI-1 devices.

Pentafluge is old enough to have been one of the first Pentium test systems for early prebeta builds of Win 95, and a number of bugs were found and corrected running Windows tests with Pentafluge. Once Win 95 was stable, I used him as my main machine for both writing and networking until last summer, when I phased in Cyrus, the Cyrix 6x86-P166. Since last November, Pentafluge has been Larry Niven's workstation when he works on our collaborative novels here. The system has also been used to test games.

Pentafluge was plenty fast enough as Larry's writing machine and as the host for the Maxoptix T3-1300 optical drive, which we use for ultrasafe backup storage, so there was no reason to speed him up other

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than that it looked like it would be easy to do. Alas, though, he wasn't fast enough for games. It seemed to take an eternity for MicroProse Software's Master of Orion II to update a turn or to shift scenes in Blizzard Entertainment's Diablo. Pentafluge's location makes that system ideal for testing games, because it's just far enough from my desk that someone can work there without distracting me. So when Intel offered me a test copy of the Pentium OverDrive processor, Pentafluge was the obvious choice.

Installing the OverDrive was incredibly easy. (You can tell I've been at a Microsoft conference; they can't have those without saying incredible in every other sentence, and it's catching.) It literally took longer to disconnect the rat's nest of wiring and lift Pentafluge up on a worktable than it did to insert the OverDrive chip once I could get at the motherboard.

The Micronics board comes with a zero insertion force (ZIF) chip mount. The old Pentium 60 chip had an externally powered fan mounted on the chip. I disconnected that, opened the lever in the chip mount, removed the old chip, looked on the detailed diagram in the instructions to be sure I had the new chip oriented properly, and dropped it in. The OverDrive has a fan, but it's powered off the chip socket; no external power connection is required.

Close the chip-socket lever and turn on the machine. It worked fine.

The OverDrive comes with a disk. The software isn't needed for the system's operation; it's a set of tests and benchmarks. You're supposed to run it before you replace your old chip, do the replacement, and run it again. I didn't do that, so I put the old chip back in, ran the diagnostics, and reinstalled the OverDrive. I did that only out of curiosity; none of the software is needed.

The result is that Pentafluge runs at least twice as fast as before, and for some operations, there seems to be even more improvement. I quickly ran all the diagnostic tests and then my standard software like Word. I tested the Ethernet connection to the other machines here and used the U.S. Robotics Courier V.Everything external modem to log on to EarthLink. No problems.

Pentafluge isn't quite as fast as a new 133-MHz Pentium-based system, but it's hard to tell the difference. I'll continue reliability tests, but I don't anticipate any problems. It may be cheaper to replace

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your motherboard and CPU than to use an OverDrive, and if you do, you'll probably have a faster machine overall; but that's a hassle, and you'll want to be sure your memory will work with the new motherboard. If you're getting bored with your old Pentium 60 and want to upgrade without installation problems, the Intel Pentium OverDrive is what you need.

While I had Pentafluge open, I swapped out the CD-ROM drive. The original was a double-speed drive, which was state of the art when Pentafluge was built but is slow now. Moreover, sometime last year, the little spring that closes the drive door broke. A couple of weeks ago I was out at Fry's and saw a bargain on a Sony SCSI six-speed CD-ROM drive, so I bought it to install the next time I had Pentafluge open. Once I was sure that the new OverDrive chip worked, I put the Sony drive in. Then I tested it "breadboard fashion" before removing the old drive and installing the new one.

Pentafluge came up all right. The BIOS reported something was wrong, but I told it to go ahead and boot Win 95 anyway. Win 95 trundled awhile looking at drivers, and all was well. I shut down, took out the old drive, fought with the rails and mounting system for the new one, and started up again.

"No boot device." After a moment of panic, I turned off the power, reversed the big SCSI-1 ribbon cable that I'd got on backward, and that took care of that. I now have a six-speed CD-ROM drive. Best of all, that was the last CD-ROM drive that needed those horrid carriers. I've always hated those carriers, and now I can get rid of them all.

If your CD-ROM drive is slow, or you're sick of the stupid carrier on your old drive, updating is pretty much foolproof, and there seem to be specials on good brand name drives every week.

MEMPHIS IS THE CODE WORD FOR Microsoft's replacement for Win 95. It's supposed to be very compatible with the upcoming NT 5.0, the major differences being security and networking. (I'm sure there are others as well.) There was a lot of talk about Memphis at WinHEC, and I've got a beta build of it I'll try out as soon as I file this column. It's said to be very stable and to fix a number of annoying bugs and bad features of Win 95.

In three days of WinHEC, there was a great deal of talk about Java.

It was fascinating to hear them talking about Memphis at WinHEC, because they never slipped up and called it anything else. The whole press corps was listening in case they dropped some hint of the final product name, but they didn't. Oh, well.

Meanwhile, wake up and smell the Java. In three days of WinHEC, there were about two mentions of Microsoft's ActiveX, while there was a great deal of talk about Java. I leave you to draw the obvious conclusion.

THE CD-ROM OF THE MONTH IS A whole series of science and education discs from DK Multimedia. They have Earth Quest, Dinosaur Hunter, general science, and discs on bugs and birds. All of them come with trial subscriptions to Science Online. DK is doing what I hoped the CD-ROM industry would do, producing well-organized original materials keyed to curious students from preteen to college age. Go to their Web site for a look. I bet you'll like what you see. This stuff is way cool.

The book of the month is Charles Harrington Elster's *There's a Word for It!* (Scribner, ISBN 0-684-82455-8). There's no better book for a dringle, and yes, I learned that word from the book. To go with it, there's William F. Buckley Jr.'s *Buckley: The Right Word* (Random House, ISBN 0-679-45214-1). They're both readable and must reads if you write much.

The computer book of the month is Que Books' *The Complete Idiot's Guide to Microsoft Word 97* (ISBN 0-7897-0953-8). Some of these *Idiot's Guides* aren't much use or are too cute for words; but this one is well written and does what it's supposed to do. I learned a lot about Word in general and Word 97 in particular.

The game of the month is Wooden Ships and Iron Men from Avalon Hill; it has a couple of odd features that take getting used to, but it's a good simulation of naval warfare in Napoleonic times.

There were two big disappointments. BattleCruiser 3000 AD is a game I looked forward to for a long time. Alas, it turns out to be unplayable. Privateer 2: The Darkening is all shoot-'em-up and nothing like the wonderful Privateer and its add-on Righteous Fire. Oh, well.

On a better note, I've been enjoying SSI's Steel Panthers II: Modern Battles, and as I promised in a previous column, I'm using it to design future battles. Finally, Master of Orion II is a great deal of fun.

I've done about 10,000 words this month. My long-suffering editor will put most of that on BYTE's Web site, including another graphics report from David Em, so be sure and look there. Meanwhile, for next month, I'm working on a Pentium II–based system, a 56-Kbps modem from U.S. Robotics that works for connecting to EarthLink, and there are piles of really interesting applications software I hope to get to. Stay tuned.

Jerry Pournelle is a science fiction writer and BYTE's senior contributing editor. You can write to Jerry c/o BYTE, 24 Hartwell Ave., Lexington, MA 02173. Please include a self-addressed, stamped envelope and put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on the Internet or BIX at **jerryp@bix.com.**

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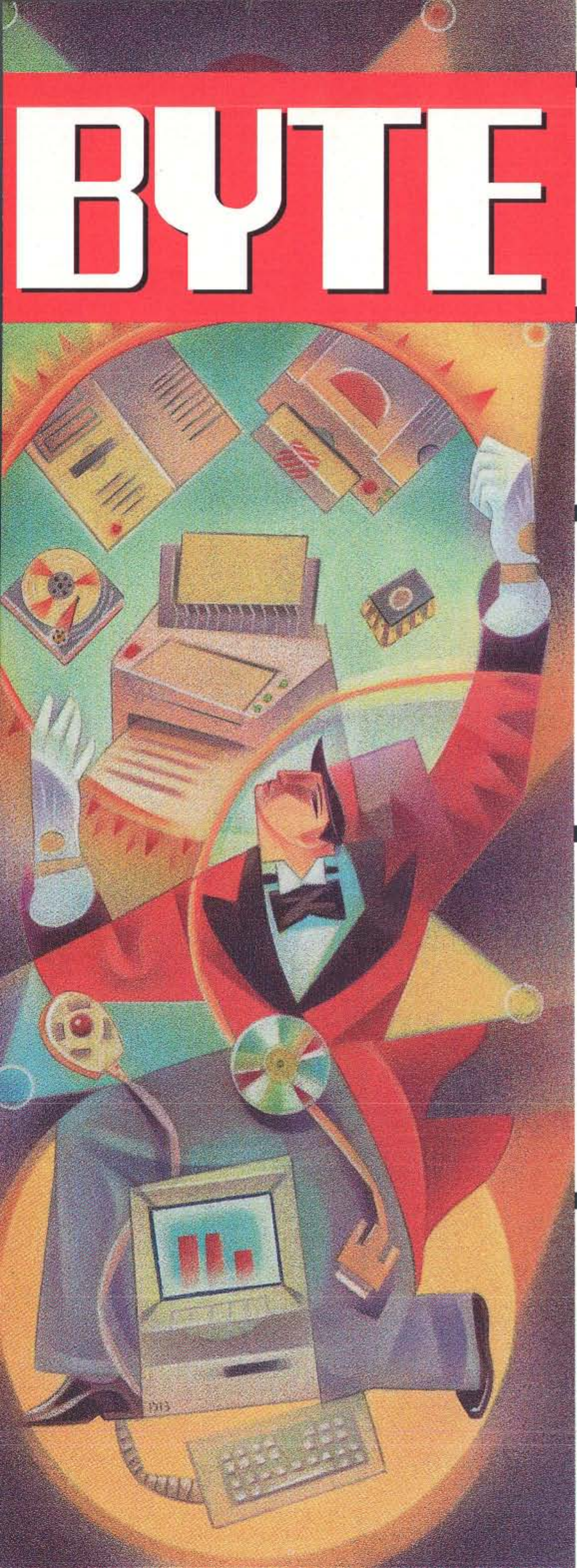

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Prolinea 575E, 100E, 120E, 575MX (pairs)	4Meg/8Meg/16Meg/32Meg	36/62/99/189
Prolinea 590MX, 5120MX (pairs)	4Meg/8Meg/16Meg/32Meg	36/62/99/189
Prolinea 6150E, 6180E (pairs)	8Meg/16Meg/32Meg	69/119/239
Prosignia 300 5/75, 5/90, 5/120, 5/150 (pairs)	4Meg/8Meg/16Meg/32Meg	36/62/99/189
Prosignia 500 5/90, 5/120, 5/150 (pairs)	4Meg/8Meg/16Meg/32Meg	36/62/99/189

COMPAQ NOTEBOOK/LAPTOP MEMORY

Armada 1120, T, 1125, 1130, T	8Meg/16Meg/32Meg/64Meg	69/129/239/689
Armada 4100, 4110, 4120, 4130 (pairs)	8Meg/16Meg/32Meg	69/129/239
Concerto 4/25, 433	***4Meg/8Meg/16Meg***	***49/79/139***
Contura 4/25, C, CX	***4Meg/8Meg/16Meg***	***49/79/139***
Contura 400C, 400CX, 410C, 410CX	***4Meg/8Meg/16Meg***	***49/79/139***
Contura 420C, 420CX, 430C, 430CX	***4Meg/8Meg/16Meg/24Meg***	***49/79/139/199***
Contura Aero 4/25, 4/33	***4Meg/8Meg/16Meg***	***39/79/139***
LTE 5000, 5100, 5200, 5300, 5400	***8Meg/16Meg/32Meg/64 Meg Kit***	***79/129/249/509***
LTE Elite 440C, CX, 4/75CX	***4Meg/8Meg/16Meg/24Meg***	***49/69/139/195***
LTE Lite 4/25	***4Meg/8Meg/16Meg***	***49/85/136***
Presario 1000, 1010, 1020, 1030, 1070, 1080	***8Meg/16Meg/32Meg***	***59/189/229***

DELL MEMORY

Dimension XPS M166S, M2000, P133s, 166s, 200s, P133v, 166v, 200v	8Meg/16Meg/32Meg	55/99/199
Dimension XPS P60, P75, P90, P100 (pairs)	4Meg/8Meg/16Meg/32Meg	26/48/89/179
Dimension XPS P100c, 120c, 133c, 166c, XPS P75T, 100T (pairs) FPM or EDO	4Meg/8Meg/16Meg/32Meg	26/48/89/179
Dimension XPS Pro 150, Pro 200 (quads)	4Meg/8Meg/16Meg/32Meg	39/69/102/209
Dimension XPS Pro 150n, 180n, 200n (pairs) edo	4Meg/8Meg/16Meg/32Meg	26/49/89/179

LASER PRINTER MEMORY UPGRADES

AMOUNT UPGRADED	0K Bd	256k	1	2	3	3.5	4	5	6	8	16	32
Brother 630, 631, 641, 645	–	–	39	59	–	–	–	–	–	–	–	–
Canon LBP 430	–	–	39	–	–	–	39	–	–	–	–	–
Canon LBP 860, 1260	–	–	–	19	–	–	39	–	–	69	89	179
Canon LBP4, 4Lite, 4plus	–	–	129	179	–	–	–	–	–	–	–	–
Epson Action Laser 1100, 1600	–	–	19	29	–	–	59	–	–	89	99	–
Epson Action Laser II	–	–	74	–	173	–	–	272	–	–	–	–
Epson 8000, 1600, 4000, 4100, 4300	–	–	89	–	173	–	–	272	–	–	–	–
Epson 1000, 1500, 5000, 5200	–	–	–	49	–	–	98	–	–	–	–	–
HP 2, 2D-	–	–	–	59	–	–	79	–	–	–	–	–
HP 3, 3D, 3P, 2P 2P+	–	–	–	***59***	–	–	***79***	–	–	–	–	–
HP 4, 4M, 4Si, 4SiMX	–	–	–	19	–	–	49	–	–	79	–	–
HP 4P, 4PLUS, 4MPm 1600, 1600CM	–	–	9	19	–	–	39	–	–	69	–	–
HP 4L	–	–	29	–	–	–	–	–	–	–	–	–
HP 3Si	–	–	9	–	–	–	39	–	–	69	–	–
HP 5L	–	–	39	49	–	–	67	–	–	99	–	–
HP 5P, 5MP, 4V, 4MV, 6P, 6MP	–	–	9	19	–	–	39	–	–	69	99	–
HP Design Jet 600, 650, 200	–	–	–	19	–	–	39	–	–	69	109	199
HP Design Jet 700, 750C Plus	–	–	–	–	–	–	29	–	–	49	89	179
HP Deskjet 500, 500C, 510, 550, 560	–	***29***	–	–	–	–	–	–	–	–	–	–
HP Deskjet 1200C, 1200C/P	–	–	–	39	–	–	49	–	–	89	–	–
HP Paintjet XL300	54	–	–	–	–	–	69	–	–	144	299	–
IBM Laser 4019, 4019E	–	–	–	–	–	109	–	–	–	–	–	–
IBM Laser 4029, 4037	–	–	–	–	–	–	49	–	–	–	–	–
IBM Laser 4039, 4079	–	–	–	***39***	–	–	***69***	–	–	***99***	–	–
Lexmark Medley 4C, 4x, 4SX	–	–	Call	Call	Call	–	–	–	–	–	–	–
Lexmark, Optra L, LX, R, RX	–	–	–	–	–	–	39	–	–	59	89	189
Lexmark Valuwriter 300,600	–	–	29	39	–	–	89	–	–	–	–	–
Lexmark Winwriter 200, 400, 600	–	–	29	39	–	–	89	–	–	–	–	–
NEC 90, 290	–	–	–	89	–	–	–	–	–	–	–	–
NEC 95, 97	–	–	–	59	–	–	–	–	–	–	–	–
Oki 400	–	–	–	59	–	–	–	–	–	–	–	–
Oki 400E, 400EX, 410E, 410EX	–	–	67	89	169	–	189	–	–	–	–	–
Oki 810E, EX, 600E, EX, 610E, EX	–	–	29	79	–	–	119	–	–	149	229	–
Oki 830, 840	–	–	–	59	–	–	–	–	–	–	–	–
Panasonic 4420/4450I	–	–	–	79	–	–	109	–	–	–	–	–
Panasonic 4410/4430	–	–	–	***59***	–	–	***89***	–	–	–	–	–
Panasonic 4450	–	–	89	–	–	–	–	–	–	–	–	–
Panasonic 4400/5400	–	–	49	69	–	–	109	–	–	–	–	–
Panasonic 4440, 5410	–	–	69	–	–	–	109	–	–	–	–	–
Panasonic 6500	–	–	14	29	–	–	69	–	–	–	–	–
Sharp 9400, 9460, 9600, 9700E	–	–	49	69	–	–	119	–	–	–	–	–
Sharp 9500, E, H, 9700, H	–	–	49	–	–	–	236	–	–	–	–	–

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Compaq Aero, 400, 410, 420, 430	109	Sharp 8700, 8800, 8900	129
Compaq LTe 5000 Series	139	TI Exstensa 450, 455, 510, 515	139
Epson Action Note 650, 660	119	TI Exstensa 550, 555, 560, 570	149
Epson Action Note 800, 866, 880, 910	119	TI Exstensa 600, 605, 650	169
IBM Thinkpad 355, 360	119	Toshiba 400, 405, 410, 415, 420, 425, 430 (NiMH)	219
IBM Thinkpad 365 C, ED, XD	129	Toshiba 100, 105, 110, 115, 200, 205	105
IBM Thinkpad 701	109	Toshiba 2100 Series	99
IBM Thinkpad 750, 755	179	Toshiba 2400, 2450, 1900, 1950, 1960	109
IBM Thinkpad 755 CD, CE, CV, CX	179	Toshiba 4700, 4800, 4850, 4900	109
NEC Versa 2400, 2405, 2430, 2435	159	Toshiba T4500, T4600	159

TOSHIBA LAPTOP MEMORY

MODEL	AMT. UPGRADED	PRICE
Tecra 500/P650	8Meg/16Meg/32Meg/48Meg/128Meg	79/118/249/369/599/1249
Tecra 700 (SDRAM)	8Meg/16Meg/32Meg	79/139/243
Tecra 710, 720	8Meg/16Meg/32Meg/64Meg/128Meg	79/139/249/649/1294
Tecra 730 CDT, 730X CDT, 740 CDT	8Meg/16Meg/32Meg/64Meg	Call
T2000SXE/2200SX/T1800, 1850, C	***8Meg***	***94.00***
T2100, 2105, 2150, 2155, 2110, 2115	***4Meg/8Meg/16Meg/24 Meg***	***39/59/129/189***
T4500, C, T4600, T4700, T1900, C, T1910, T1950 (3.3 v)	***4Meg***	***39.00***
T4500, C, T4600, T4700, T1900, C, T1910, T1950 (3.3 v)	***8Meg***	***79.00***
T4500, C, T4600, T4700, T1900, C, T1910, T1950 (3.3 v)	***16Meg/32Meg***	***139/243***
T3400CT, T2400, T3600	***4Meg/8Meg/16Meg/24Meg***	***59/79/149/199***
T100, 105, 110, 115, 205, 210	***8Meg/16Meg/32Meg***	***79/129/239***
T400, 405, 410, 415, 420, 425, 430	***8Meg/16Meg/32Meg***	***79/129/239***
T400CS, 400CDT, T100, 105 Edo	8Meg/16Meg/32Meg	79/129/239
T600, 610, CT Edo, 660	8Meg/16Meg/32Meg	79/129/239

NOTEBOOK, LAPTOP MEMORY

MODEL	AMT. UPGRADED	PRICE
ACERNote 730C, 735C, 760C, 760CX, 780CX	***2Meg/4Meg/8Meg***	***39/59/89***
ACERNote 763, 765, 782, 784, 786	4Meg/8Meg/16Meg	49/69/129
ACERNote Light 350, 352, 355	***4Meg/8Meg/16Meg***	***49/69/129***
ACERNote Light 356, 358, 359, 361 (pairs) edo	***4Meg/8Meg/16Meg***	***49/69/129***
ACERNote Nuovo 971, 972	8Meg/16Meg/32Meg	69/125/239
ACERNote Pro 950, 954, 955, 957, 959 (pairs)	4Meg/8Meg/16Meg	59/79/139
Ambra SN Series	***4Meg/16 Meg***	***69/149***
Ambra N-75, N-100	***4Meg/8/16***	***49/79/139***
AST Ascentia A41, A42	***8Meg/16Meg/32Meg/64Meg***	***79/139/289/629***
AST Ascentia P30, P50	8Meg/16Meg/32Meg	79/149/269
AST Ascentia J10, J30,J50	8Meg/16Meg/32Meg/40Meg Kit	79/129/249/359
AST Ascentia 900N, 800N, 810, 910	***8Meg/16Meg***	***79/129***
AST Ascentia 950	***8Meg/16Meg***	***79/139***
AST Bravo & Explorer	***4Meg/16Meg***	***79/149***
AT&T Globalyst 130, 200, 250	***4Meg/8Meg/16Meg***	***49/79/139***
Austin DX4, DX2, SX2, SX Series	***4Meg/16Meg***	***69/189***
Austin Edge CD P-133 edo	8Meg/16Meg	89/149
Austin Edge Duet (pairs) edo	16Meg/32Meg	129/229
Austin Vista	4Meg/8Meg/16Meg/24Meg	49/79/139/199
Canon 1100 (pairs)	***4Meg/8Meg/16Meg***	***59/79/129***
Canon Innova Book 150, 175	***4Meg/16Meg***	***59/139***
Canon Innova Book 200LS	4Meg/8Meg/16Meg/24Meg	59/89/179/249
Canon Innova Book 350CD, 360, 475	8Meg/16Meg	59/129
Canon Innova Book 480, 490 edo	***8Meg/16Meg***	***89/149***
CTX EZ Book 500, 600, 700 Pent. Series	4Meg/8Meg/16Meg	59/89/139
DEC HiNote	***4Meg/8Meg/16Meg***	***59/89/139***
DEC HiNote Ultra, Ultra II	4Meg/8Meg/16Meg	49/69/129
DEC HiNote VP 520, 525, 535, 545 (pairs)	8Meg/16Meg/32Meg	89/139/269
DEC HiNote VP 5100, 5120	8Meg/16Meg/32Meg/64Meg	79/139/219/699
DEC HiNote VP, Css, LSS, CTS, LTS	8Meg/16Meg/32Meg	79/139/269
Dell Latitude LM (pairs)	4Meg/8Meg/16Meg	59/79/129
Dell Latitude 433, C, CX	4Meg/16Meg	69/149
Dell Latitude LX, M	***4Meg/8Meg/16Meg***	***59/89/139***
Dell Latitude XP, XPi	4 Meg/8Meg/16Meg	59/79/129
Epson ActionNote 650, 650c, 660c, 660cx	***4Meg/8Meg/16Meg***	***39/79/139***
Epson ActionNote 880, 886c, 890, 910	4Meg/8Meg/16Meg/20Meg	49/79/139/199
Epson ActionNote 4LC/25, 4LC/33, 4SLC/2-50, 4000	***8Meg***	***89.00***
Fujitsu Lifebook 500, 600 Series edo	8Meg/16Meg/32Meg	69/139/269
Fujitsu Monte Carlo, Montego, Milan	8Meg/16Meg/32Meg	69/139/269
Gateway 2000 Colorbook 4/33	***4Meg/16Meg***	***69/179***
Gateway 2000 Nomad 425 DXL/SXL	***4Meg/16Meg***	***140/559***
Gateway 2000 486 Handbook or Liberty	4Meg/16Meg	49/139
Gateway 2000 Solo Series	4Meg/8Meg/16Meg	69/89/139
Gateway Solo Series 2100, 2200 edo	8Meg/16Meg	89/139
Hitachi C-Series	8Meg/16Meg/32Meg	79/129/229
Hitachi E-Series, MX Series	***8Meg/16Meg/32Meg***	***79/139/269***
Hitachi M-Series	***8Meg/16Meg/32Meg***	***69/119/249***
HP Omnibook 530, 600	***4Meg/8Meg/12Meg***	***49/69/99***
HP Omnibook 800	8Meg/16Meg/32Meg	79/129/349
HP Omnibook 4000	***4Meg/8Meg/16Meg***	***59/89/139***
HP Omnibook 5000, 5500	***8Meg/16Meg/32Meg***	***79/139/256***
Leading Edge Aviva 2000	16Meg	139
Micron Transport Pentium (pairs)	8Meg/16Meg	89/149
Midwest Micro Elite or Soundbook	4Meg/8Meg/16Meg	69/99/149
Midwest Micro Elite or Soundbook Plus or Sidle II, IP	4Meg/8Meg/16Meg	69/99/149
Midwest Micro Elite or Soundbook CD	4Meg/8Meg/16Meg	69/99/149
NEC Ultralite Versa, E, V, MP	***4 Meg/8Meg/16Meg/20Meg/32Meg***	***9/69/129/179/239***
NEC Versa S, Versa 2000C, D, 2205C	***4Meg/8Meg/16Meg***	***49/79/129***
NEC Versa 4000, 4050/4080, 4200	4Meg/8Meg/16Meg/32Meg	59/79/139/299
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Olivetti Echos P75-P133S (pairs)	4Meg/8Meg/16Meg	59/89/149
Packard Bell Statesman	***2Meg/8Meg***	***29/79***
Panasonic CF-V21P, CF-580	***4Meg/16Meg***	***49/144***
Panasonic CF-V41	***4Meg/8Meg/16Meg/32Meg***	***49/69/139/289***
Sager Midern, all models	***4Meg/8Meg/16Meg/32Meg***	***69/99/169/399***
Samsung Sens 810	***8Meg/16Meg/32Meg***	***79/139/247***
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Sharp 3030, 3040, 3070	8Meg/16Meg/32Meg	89/129/269
Sharp 8150, 8650, 8660, 7700, 7760	***4Meg/16Meg***	***69/139***
Sharp 8700, 8800, 8900	***4Meg/8Meg/16Meg***	***49/69/139***
Sharp 3010, 3020, 3050, 3060	***4Meg/8Meg/16Meg/32Meg***	***49/79/141/269***
Sharp 9000, 9030	8Meg/16Meg/32Meg	69/129/249
Sharp 9020, 9050, 9300, T edo	8Meg/16Meg/32Meg	69/129/249
Sharp 9040, 9070 (pairs)	4Meg/8Meg/16Meg/32Meg	49/99/149/525
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TI Extensa, 600, 605, 650, 655, 665	***8Meg/16Meg/32Meg***	***69/129/349***
TI Extensa, 600, 605, 650, 900, T, CDT edo	***8Meg/16Meg/32Meg***	***Call***
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Ultra 486 TS38	4Meg/8Meg/16Meg	69/89/169
Winbook FX 100, 133, 150	16Meg/32Meg	129/269
Winbook XP	***16Meg/32Meg***	***129/257***
Winbook XP5	***32Meg***	***259***
Zenith Z-Note MX	***4Meg/8Meg/16Meg***	***69/89/139***
Zenity Z-Note GT (pairs)	***4Meg/8Meg/16Meg***	***59/89/129***
Zenith Z-Star 4/33	***2Meg/8Meg***	***29/79***
Zenith Z-Star EX, ES	***4Meg/8Meg/16Meg***	***59/89/139***

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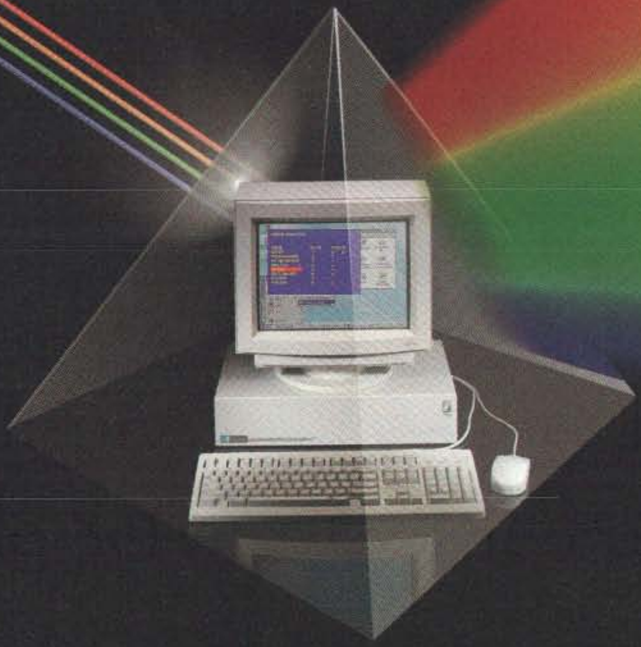

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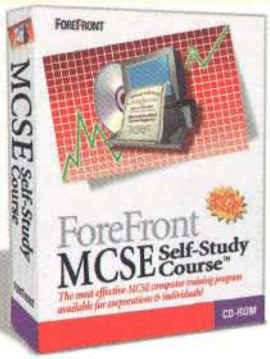
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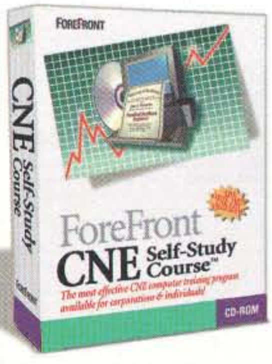
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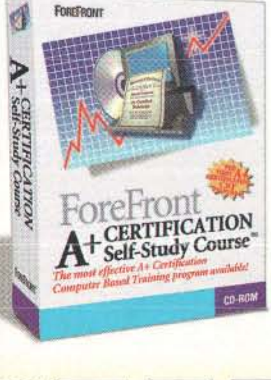
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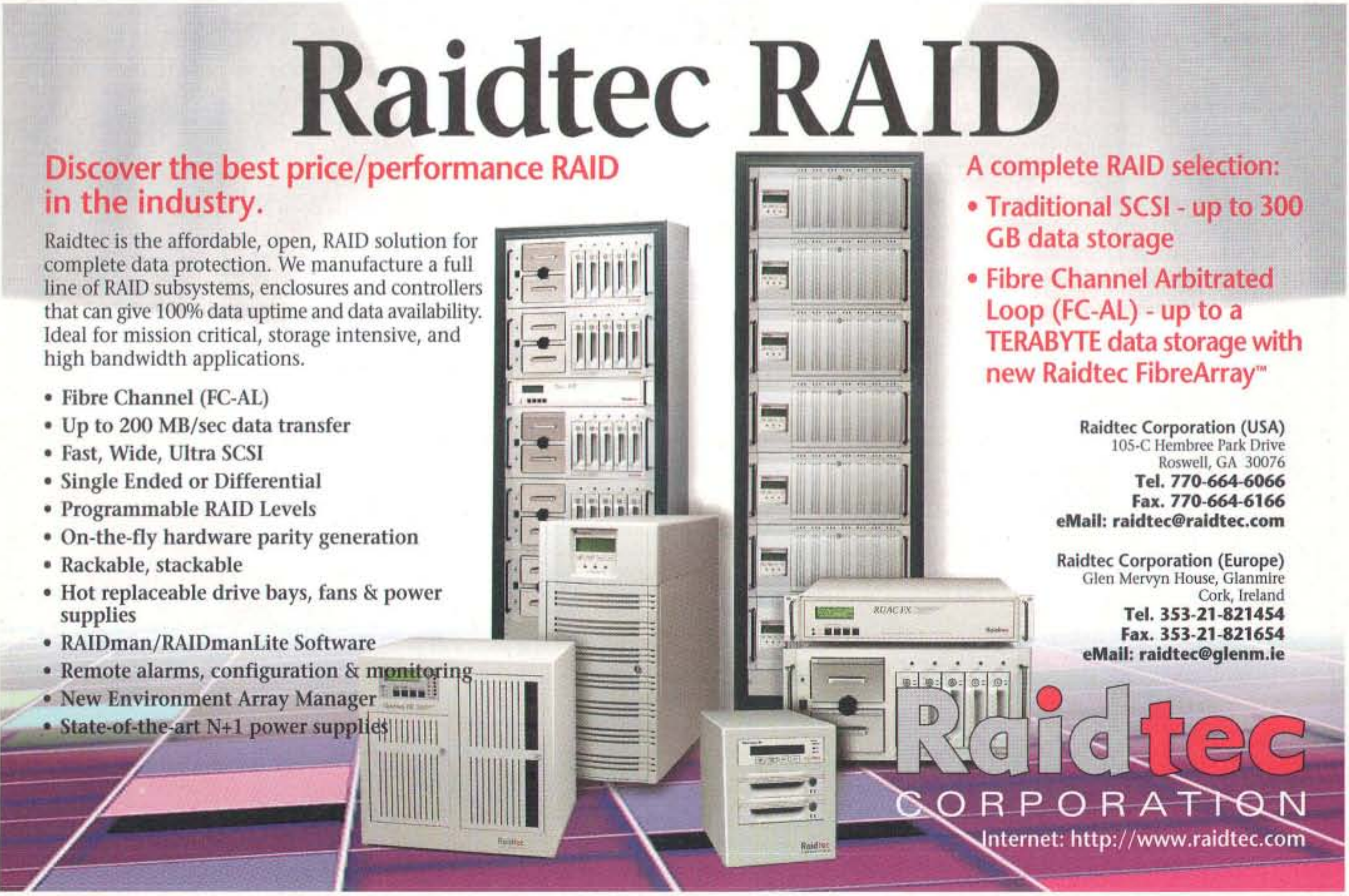

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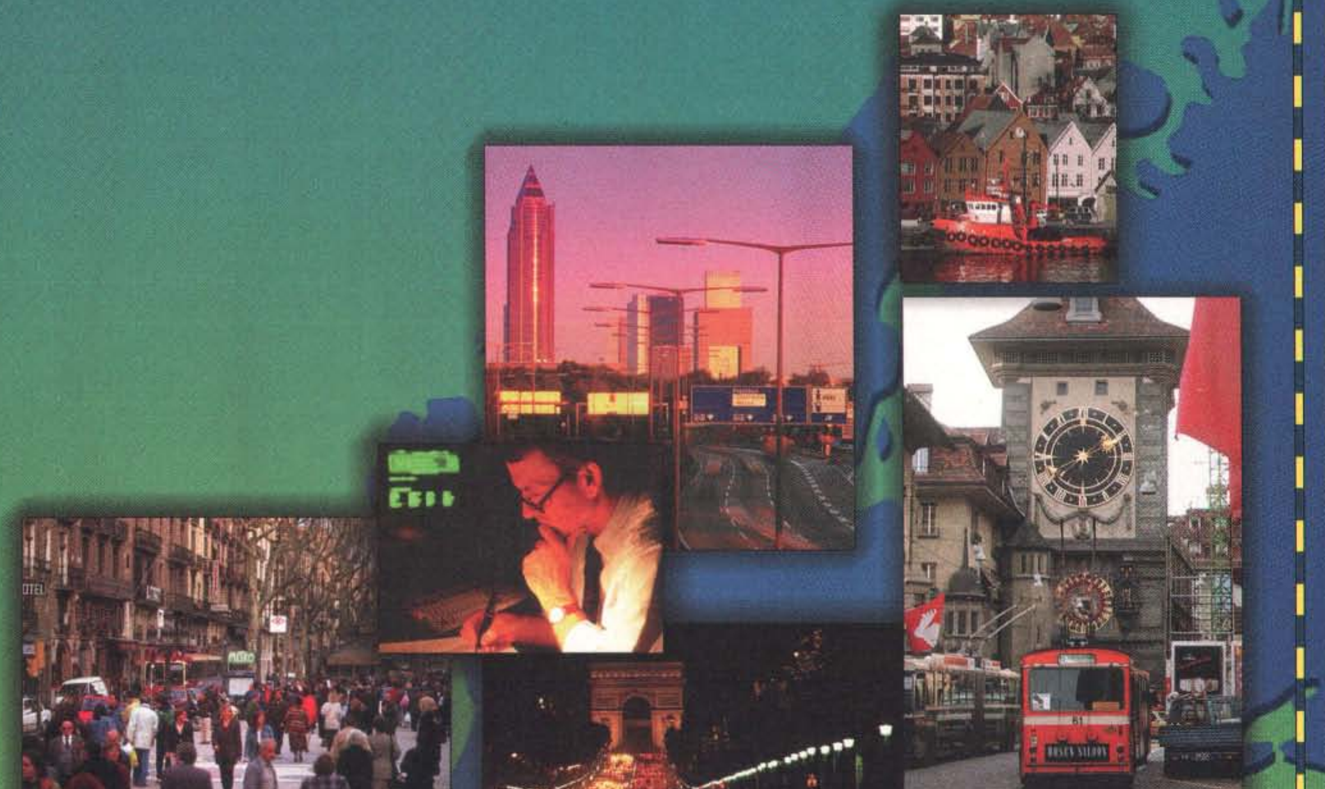

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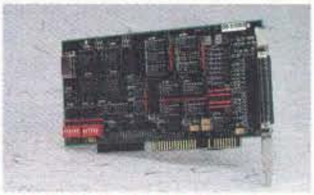

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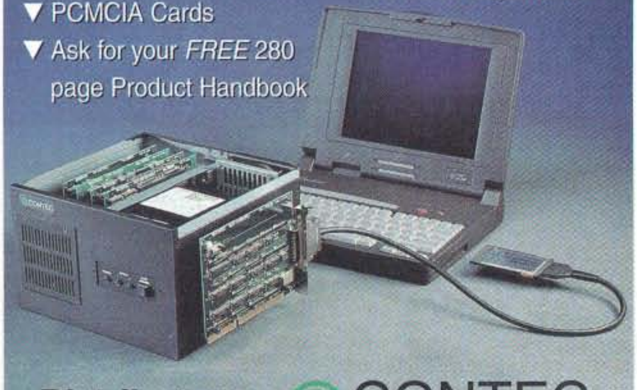

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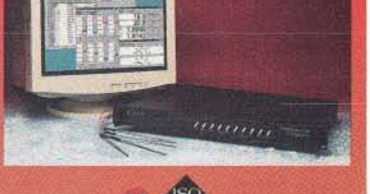

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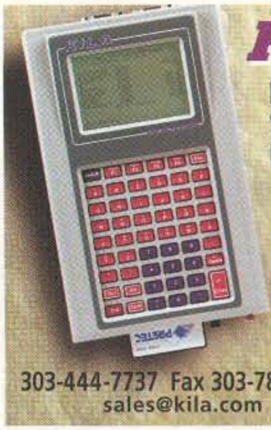

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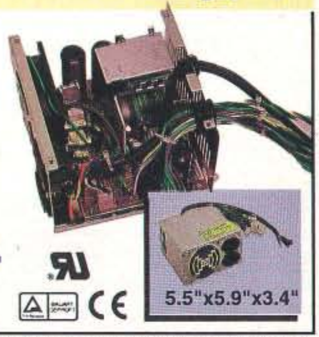

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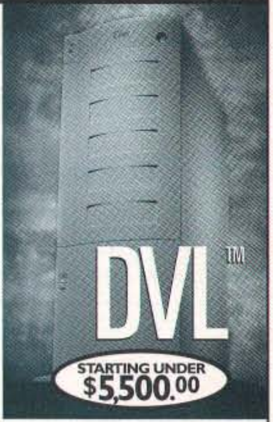

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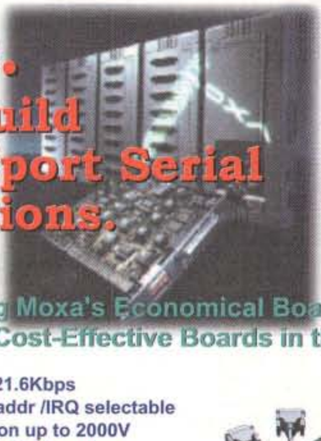

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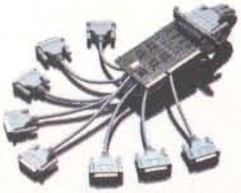

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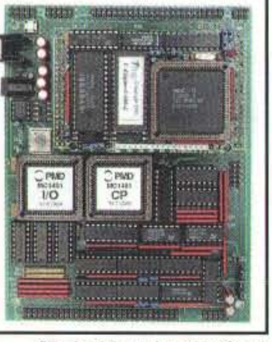

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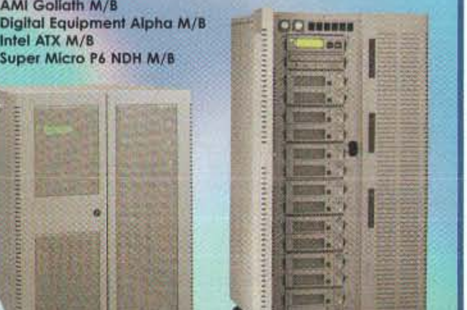

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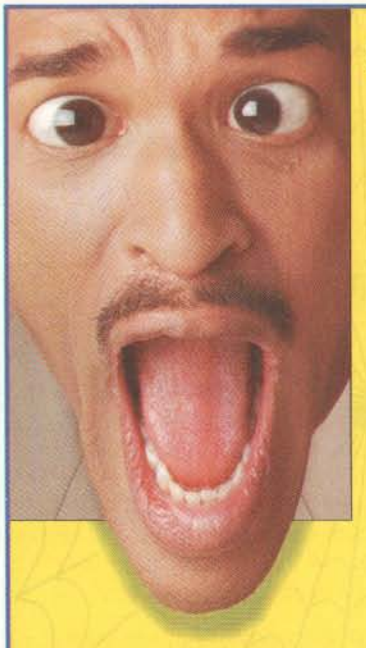

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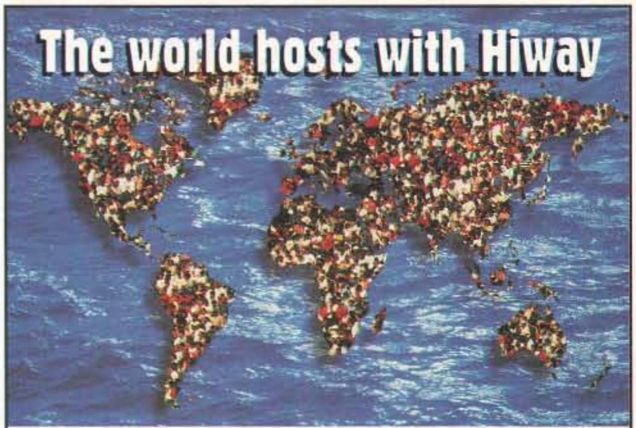
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BYTE ADVERTISING SALES STAFF

Michael P. Walsh, Associate Publisher, 24 Hartwell Avenue, Lexington, MA 02173,
Tel: 617-860-6714, Fax: 617-860-6179, mike_walsh@mcgraw-hill.com
Lori Silverstein, Eastern Regional Sales Director, 921 Eastwind Drive, Suite 118, Westerville, OH 43081,
Tel: 614-899-4908, Fax: 614-899-4999, lorisf@mcgraw-hill.com
Jim Hussey, Western Regional Sales Director, 1900 O'Farrell Street, Suite 200, San Mateo, CA 94403,
Tel: 415-860-6861, Fax: 415-513-6867, jim_hussey@mcgraw-hill.com

MID ATLANTIC
NY, Metro NJ, DC, DE, MD, PA, VA, WV
Don Calamaro 212-512-4811
doncalamaro@mcgraw-hill.com
John Ferraro 212-512-2555
jferraro@mcgraw-hill.com
Jill Pollak 212-512-3585
jpollak@mcgraw-hill.com
The McGraw-Hill Companies
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New York, NY 10020
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Kirstin Pihl 404-843-4765
kpihl@mcgraw-hill.com
The McGraw-Hill Companies
4170 Ashford-Dunwoody Road
Suite 520
Atlanta, GA 30319-1465
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Paul Franchak 614-899-4912
franchak@mcgraw-hill.com
The McGraw-Hill Companies
921 Eastwind Drive, Suite 118
Westerville, OH 43081
FAX: 614-899-4999

NEW ENGLAND
CT, MA, ME, NH, NY, RI, VT,
Ontario, Canada, Eastern Canada
Edward Marecki 401-351-0274
617-860-6221
ed_marecki@mcgraw-hill.com
BYTE Magazine
One Richmond Square
Providence, RI 02906
FAX: 401-351-0276

NORTH PACIFIC
AK, Northern CA, HI, ID, MT, OR,
Silicon Valley, WA, WY,
Western Canada
Lisa Farrell 415-513-6862
lfarrell@mcgraw-hill.com
The McGraw-Hill Companies
1900 O'Farrell Street, Suite 200
San Mateo, CA 94403
FAX: 415-513-6867

SOUTH PACIFIC
AZ, Southern CA, CO, NM, NV, UT
Beth Dudas 714-443-9314
bdudas@mcgraw-hill.com
Geanette Perez
gperez@mcgraw-hill.com
The McGraw-Hill Companies
635 Camino de los Mares, Suite 212
San Clemente, CA 92672
FAX: 714-443-9602

SOUTHWEST, ROCKY MOUNTAIN
AL, AR, LA, MS, OK, TN, TX
Bert Panganiban 214-688-5165
bertpang@mcgraw-hill.com
Chrissy Copple 214-688-5171
ccopple@mcgraw-hill.com
The McGraw-Hill Companies
Mockingbird Towers, Suite 1104E
1341 W. Mockingbird Lane
Dallas, TX 75247-6913
FAX: 214-688-5167

PETERBOROUGH, NH OFFICE
Sales FAX: 603-924-2683
Advertising FAX: 603-924-7507

BUYERS MART
Mark Stone 603-924-2533
stonem@mcgraw-hill.com
BYTE
One Phoenix Mill Lane
Peterborough, NH 03458

BYTE Deck
Brian Higgins 603-924-2596
bhiggins@mcgraw-hill.com
BYTE
One Phoenix Mill Lane
Peterborough, NH 03458

EURO-DECK
Mark Stone 603-924-2533
stonem@mcgraw-hill.com
BYTE
One Phoenix Mill Lane
Peterborough, NH 03458

ADVERTISING PRODUCTION
Advertising/Production FAX:
603-924-7507

Advertising Production Manager:
Linda Fluhr 603-924-2540
lfluhr@mcgraw-hill.com

Senior Advertising Production Coordinator:
Lyda Clark 603-924-2545
lclark@mcgraw-hill.com

Advertising Production Coordinators:
Karen Cilley 603-924-2557
kcilley@mcgraw-hill.com

Rod Holden 603-924-2675
wholden@mcgraw-hill.com

Senior Operations Coordinator:
Lisa Jo Steiner 603-924-2540
lisajo@mcgraw-hill.com

Advertising Graphics Manager:
Susan Kingsbury 603-924-2507
suekings@mcgraw-hill.com

MARKETING AND PLANNING
Market Information Manager:
Edward Fielding 617-860-6344
FAX: 617-860-6822
fielding@mcgraw-hill.com

Market Information Coordinator:
Dylan DiGregorio 617-860-6267
FAX: 617-860-6822
digregor@mcgraw-hill.com

Marketing Communications Manager:
Carol Sanchioni 603-924-2505
FAX: 603-924-2683
csanch@mcgraw-hill.com

Assistant Manager, Trade Shows and Special Events:
Arja Neukam 617-860-6378
FAX: 617-860-6307
aneukam@mcgraw-hill.com

Marketing Services Coordinator:
Kate Woodhouse 617-860-6361
FAX: 617-860-6307
woodhous@mcgraw-hill.com

INTERNATIONAL ADVERTISING SALES STAFF

Lori Silverstein, International Sales Director, 921 Eastwind Drive, Suite 118, Westerville, OH 43081 U.S.A.,
Tel: +614-899-4908, Fax: +614-899-4999, lorisf@mcgraw-hill.com

BYTE ASIA-PACIFIC
AUSTRALIA, HONG KONG, INDIA, INDONESIA, KOREA, MALAYSIA, PAKISTAN, PHILIPPINES, OTHER ASIA AND PACIFIC COUNTRIES, SINGAPORE, TAIWAN
Weiyee In
weiin@mcgraw-hill.com
Jennifer Chen
jennchen@mcgraw-hill.com
#305 Nanking East Road,
Section 3, 10th floor
Taipei, Taiwan, R.O.C.
Tel: +886-2-715-2205
FAX: +886-2-715-2342

KOREA
Young-Seoh Chinn
JES Media International
6th Fl., Donghye Bldg.
47-16, Myungil-Dong
Kangdong-Gu
Seoul 134-070, Korea
Tel: +82-2-4813411
FAX: +82-4813414

GERMANY, SWITZERLAND, AUSTRIA
Jürgen Heise
jheise@mcgraw-hill.com
The McGraw-Hill Companies
Adam-Berg-Str. 115a
D-81735 Munich
Germany
Tel: +49-89-680701-16
FAX: +49-89-680701-18

ISRAEL
Dan Aronovic
rhodanny@actcom.co.il
DARA International
41 Ravutski
Ra'anana 43220
Israel
Tel: +972-9-7419544
FAX: +972-9-7481934

ITALY, FRANCE, SPAIN, PORTUGAL, SCANDINAVIA
Zena Coupé, Amanda Blaskett
101645.1710@compuserve.com
A-Z International Sales Ltd.
70 Chalk Farm Road
London NW1 8AN
England
Tel: +44 171 2843171
FAX: +44 171 2843174

JAPAN
Hirokazu Morita
Japanese Advertising
Communications, Inc.
Three Star Building
3-10-3 Kanda Jimbocho
Chiyoda-ku, Tokyo 101 Japan
Tel: +81 3 3261 4591
FAX: +81 3 3261 6126

UNITED KINGDOM, BENELUX
Jonathan McGowan
jonmcgow@mcgraw-hill.com
Tel: +44 171 495 6781
Marc Green
Tel: +44 171 495 6780
The McGraw-Hill Companies
34 Dover St.
London W1X 4BR
England
FAX: +44 171 4956734

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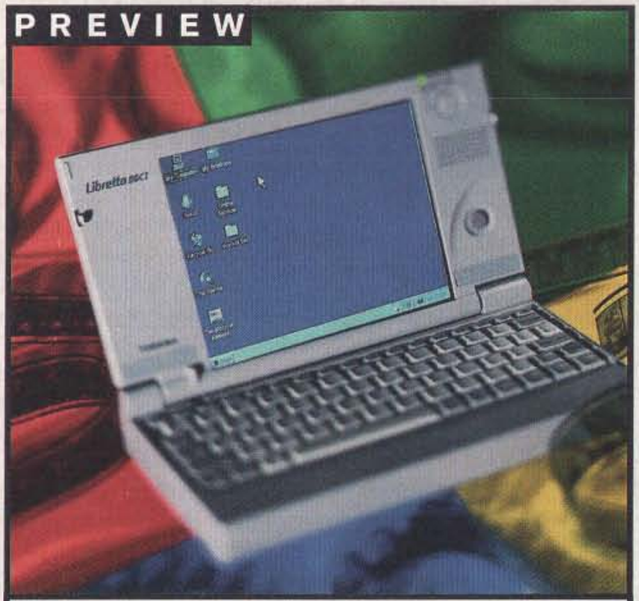
What's New

Hardware

New Pentium notebooks, Motorola's 300-MHz Mac clone, low-cost videoconferencing, and help for developers.

PREVIEW



Libretto 50
$2000

Enter 1061 on Inquiry Card.

Toshiba America Information Systems
Irvine, CA
714-583-3000
http://www.toshiba.com

A Little Notebook with Bite

The Toshiba Libretto 50 (around $2000) is not quite a palmtop, yet it's not a full notebook. It's a subnotebook that runs under Windows 95, not Windows CE. Previously available only in Japan, the Libretto 50 has a 75-MHz Intel Pentium processor, 760-MB hard disk, and 16 MB of EDO DRAM (expandable to 32 MB).

By removing the CD-ROM drive, Toshiba cut the Libretto's weight to 1.87 pounds. A portable CD-ROM drive is available that plugs into a SCSI port replicator. You can also hook up a PC Card-based floppy disk drive. The Libretto has a parallel port, ECP parallel support, and IR capabilities. The IR interface and port replicator make for quick file transfers and access to office information. A 6.1-inch color active matrix TFT display at the standard 640 by 480 resolution and Sound Blaster Pro Card make multimedia demonstrations possible on a small, though not ideal, scale. The notebook uses a rechargeable lithium-ion battery pack. The test model we saw had an impractically small keyboard, but Toshiba assured us that the production model will be resized for human hands.

The Libretto is ideal for checking e-mail on the road, as well as word processing and data acquisition. But even with a resized keypad, this subnotebook's small screen makes it impractical as a desktop replacement, but it is an interesting alternative for road warriors who don't want a bulky, standard notebook. **– Jason Krause**

PHOTOGRAPH: DARYL SOLOMON © 1997

Scanners

Workgroup Scanner

BELL AND HOWELL'S COPISCAN 4040D ($7495), designed for an office workgroup environment, aims to process high volumes of documents with minimum breakdown time. The document feeder handles 40 pages per minute or 80 images per minute and a daily duty cycle of 3000 sheets. The Copiscan 4040D handles paper sizes from 2¾ x 2¾ inches to 8½ x 14. "Adaptive contrast enhancement" improves grayscale output, the company says. The unit has a SCSI-2 interface. Capture retrieval software is included.
Contact: Bell & Howell, Skokie, IL, 800-SCAN-494; http://www.bellhowell.com.
Enter 1062 on Inquiry Card.

Notebooks

Pentium Notebooks Under $3000

TATUNG'S TNB-5600 IS A NEW LINE OF Pentium notebooks priced under $3000. The CPUs range from 150 MHz to 200 MHz with MMX. There are two LCD options: 12.1- or 11.3-inch TFT. The units ship with 16 or 32 MB of DRAM, with one DIMM socket for up to 64 MB. A removable 10X CD-ROM and 2.5-inch hard disk drive are included. A 33.6-Kbps modem, PC Card slot (one Type III or two Type II), I/O ports, 16-bit sound card, and LAN 10Base-T are also included.
Contact: Tatung, Long Beach, CA, 800-829-2850 or 310-637-2150; http://www.tatung.com.
Enter 1064 on Inquiry Card.

Traveling Multimedia

THE ASCENTIA A SERIES ($2999) FROM AST offers high-performance multimedia and communications in a midrange notebook. The series comes with either a 150-MHz processor with MMX or a 150-MHz Pentium processor, a 1.44-GB hard drive, 256-KB level 2 cache, CD-ROM drive, and 16 MB of standard RAM (expandable to 80 MB). Multimedia applications are augmented by a 12.1-inch Super VGA TFT display, SRS 3-D sound capability, 2 MB of video RAM, embedded stereo speaker and microphone, and 8-/16-bit stereo/mono playback and recording capabilities.
Contact: AST, Irvine, CA, 714-727-4141; http://www.ast.com.
Enter 1063 on Inquiry Card.

Systems

More Power from a Mac Clone

MOTOROLA'S STARMAX 5000/300 MAC clone, a 300-MHz system based on the PowerPC 603e chip, represents a jump in performance for Mac users. The 5000/300 minitower

($2899) includes 512 KB of L2 cache, Mac OS 7.6, 16X CD-ROM drive, five PCI slots, a 4.3-GB hard drive, 10Base-T Ethernet, 4 MB of VRAM, 100-MB Iomega Zip drive, and software utility packages. For the graphics professional, Motorola will offer a version of the StarMax 5000/300 with an IMS Twin Turbo video card (and 8 MB of onboard memory) for $3399.

Contact: Motorola, Tempe, AZ, 602-438-3000; http://www.motorola.com.
Enter 1065 on Inquiry Card.

Embedded Systems

Up to 72 Megs in One Chip

M-Systems DiskOnChip 2000 is a 32-pin JEDEC package ($67 in OEM quantities) that will give embedded designers up to 72 MB in a single chip. The DiskOnChip is technology-independent and offers full backward and forward compatibility. Chips with 2, 4, 6, and 24 MB are available immediately, with the 72-MB version to follow. The chips work with several OSes, including Win 95, and come with appropriate drivers, the company says.

Contact: M-Systems, Santa Clara, CA, 408-654-5820; info@ccm.msyscal.com.
Enter 1066 on Inquiry Card.

Peripherals

Computing at Your Fingertips

If pushing a mouse around all day is too strenuous, you might consider Interlink Electronics' VersaPad ($69.95), which lets you move your cursor with the touch of a fingertip. You can manipulate the VersaPad with finger or stylus in Windows 95 applications. The handheld tablet is sensitive like a touchscreen. Light pressure on the VersaPad's screen directs the cursor, and buttons off to one side are preprogrammed with the functions "cut and paste" and "save." It also includes buttons for easy scrolling that let you pan across the screen at different rates of speed.

Contact: Interlink Electronics, Camarillo, CA, 805-484-8855; http://www.interlink.com.
Enter 1067 on Inquiry Card.

Handy CD-ROM Drive

The Backpack Bantam ($299, or $379 with sound card), an 8X CD-ROM drive, fits in the palm of your hand. Weighing in at 1.5 pounds and with dimensions of 1 x 8 x 6 inches, the Backpack Bantam is ideal for mobile professionals who need portable multimedia hardware or simply can't fit any more applications on their hard disk. The device offers Windows sound capabilities for laptops and a parallel port interface.

Contact: MicroSolutions, DeKalb, IL, 800-890-7227 ext. 200 or 815-756-2928; http://www.microsolutions.com.
Enter 1068 on Inquiry Card.

New Battery Technology for Portables

"Starved electrolyte" lead acid is a new technology for longer battery life. 1-800-Batteries' 7-Hour Power Pack ($149) means to do its name proud by offering up to seven hours of life for laptops and up to seven days for cellular phones. The battery weighs just under 3 pounds. It comes with its own self-charging unit and car lighter jack for mobile recharging.

Contact: 1-800-Batteries, San Jose, CA, 800-228-8374 or 408-879-1930; http://www.powerexpress.com.
Enter 1069 on Inquiry Card.

Smarter SCSI

Super SCSI ($195), combining intelligent software and hardware, automatically installs and configures an adapter board in a PC. SuperSCSI's graphical interface allows the user to view the status of all devices on the SCSI chain. The AdvanSys Ultra host adapter includes bus-mastering technology for enhanced I/O throughput. The software package automatically identifies problems with SCSI hardware and software installation and, together with an on-line help guide, walks the user through the steps necessary to properly install the host adapter.

Contact: Advansys Inc., San Jose, CA, 408-383-9400; http://www.advansys.com.
Enter 1070 on Inquiry Card.

Communications

Modem Management

Motorola's 3460 Fast'R Modem ($595 for stand-alone model) is designed for network managers and MIS groups for remote access, SNA lease line, or dial-up analog applications. The Windows-based Fast'R Vu software allows for configuration, status checking, and testing of multiple modems in minutes. Offered as a stand-alone unit that can be stacked up to six modems high or in a nest-card version, which holds 32 modems in a single chassis, it can be accessed through a network management port on the back panel. A GUI allows users to monitor and configure all standard modem operations.

Contact: Motorola, Tempe, AZ, 602-438-3000; http://www.motorola.com.
Enter 1071 on Inquiry Card.

Plug 'n' Play ATM

You can achieve plug-and-play ATM connectivity at the price of Fast Ethernet products with Fore Systems' Forerunner LE ($650 per 155-Mbps port, $3000 per 622-Mbps port). It's an ATM network interface card supporting videoconferencing, video on demand, remote collaboration, and telephony integration. A bundled workgroup version of Forerunner is available with adapters for individual connections at $300. Forerunner supports Windows 95, NT, OS/2 Warp Connect, Novell NetWare, and Open Transport.

Contact: Fore Systems, Warrendale, PA, 412-742-4444; http://www.fore.com.
Enter 1072 on Inquiry Card.

Printers

New Printer Family

Minolta has introduced PageWorks, a family of compact monochrome and color laser printers. The flagship of this line is the Color PageWorks ($3499) printer with 600-dpi resolution. It's capable of 3 ppm with color prints and 12 ppm with monochrome. The printer uses Minolta's Intermediate Transfer Belt to print all four colors at once, which saves time and facilitates accurate toner placement, the company says. RealTime Memory Compression Technology allows even complex graphics to print using only 4 MB of memory. Color PageWorks has a bidirectional parallel interface and optional Ethernet and Token Ring multiprotocol high-speed network boards for IPX/SPX, TCP/IP, Ethertalk, and Windows NT environments.

Contact: Minolta,

Ramsey, NJ, 201-825-4000; http://www.minolta.com.
Enter 1073 on Inquiry Card.

More dpi for Your Dollar

Lexmark's 7000 Color Jetprinter ($399) fights for the title of "highest resolution for an ink-jet printer in its category." The printer features print elements that let it produce 1200 by 1200 dpi. Laser-crafted print nozzles are uniform and small, allowing more jets to fit on the print head. The ink jets will not clog as fast as traditional jets because more of the nozzles can rest during printing, reducing wear, tear, and residue buildup, the company says. The Lexmark 7000 is meant for high-end home and small office use.

Contact: Lexmark,
Lexington, KY,
1-800-LEXMARK;
http://www.lexmark.com.
Enter 1074 on Inquiry Card.

Servers

CD-ROM Servers

Legacy Storage Systems' SmartArray CD-ROM servers provide access to 16, 28, or 48 CD-ROMs through SCSI-2 Fast 4 disk-changer devices. The SmartArray is a tower with redundant power supplies and cooling fans that connects directly to Ethernet or Token Ring networks through an intelligent Axis StorPoint controller. It supports all major platforms. To make disk insertion easier, the server uses a four-CD autochanger instead of disk caddies, cartridges, or magazines. Maximum capacities for the CD-16, CD-28, and CD-48 are 10.4 GB, 18.2 GB, and 31.2 GB, respectively.
Contact: Legacy Storage Systems, Markham, Ontario, Canada, 905-475-1077;
http://www.legacy.ca.
Enter 1075 on Inquiry Card.

Higher Internet Throughput

MultiTech's CommPlete Server ($62,345) is designed for higher throughputs for Internet and intranet applications. The segmented architecture has up to four independent Pentium servers running identical or different applications. Each segment can terminate a single T1 digital link, providing the processing capability of a Pentium on up to 24 lines. All 24 lines can run FTP transfers at K56flex speeds or 64K ISDN speeds without performance loss, MultiTech says.
Contact: MultiTech,
Mounds View, MN,
800-328-9717 or
612-785-3500;
http://www.multitech.com.
Enter 1076 on Inquiry Card.

Notebooks

Take High-Quality Audio on the Road

Musicians, presenters, and audio producers can use the EMU8710 ($395) PC Card for laptops in presentations as well as mobile recording sessions. This card provides CD-quality digital audio and wave-table music on a standard Windows 95 system. Business presenters have superior audio at their disposal that works with presentation programs like Power Point, Astound, and Persuasion. Musicians and audio producers can capture, edit, and produce digital audio files without a studio. You can save 512 KB of sound from raw WAV files, which can be triggered with MIDI sequencing programs and integrated digital audio/MIDI software.
Contact: E-mu,
Scotts Valley, CA,
408-438-1921;
http://www.emu.com.
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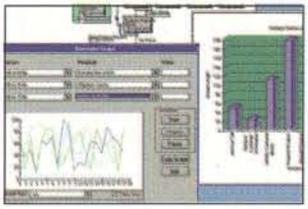
SOFTWARE

Databases

Corporate Cooperation

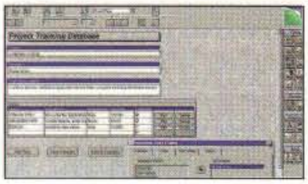
CASEwise's Modeler ($3500) is a shared modeling repository that integrates human-resource business process simulation, corporate finance, and data modeling. Modeler makes possible the ideal of complete integration of interdepartmental data, the company says. A graphical interface maps out the hierarchical relationships between business processes, each according to its position in the system's architecture. Legacy data can be reverse-engineered into the data repository. Data can be manipulated and accessed with software like Microsoft's Office suite, and training, IT specifications, and other documents can be generated in HTML format. Modeler can import models from other products, and it can export into tools like Visual Basic or PowerBuilder.



Contact: CASEwise,
Waltham, MA, 800-893-8398
or 617-895-9900;
http://www.casewise.com.
Enter 1079 on Inquiry Card.

Express Access to Your Database

Netiva's Web Database Application ($299, or $2999 for unlimited licenses) not only eliminates HTTP servers, SQL, CGI programs, and HTML, it also lets you produce database applications that are instantly available to multiple users through Web browsers. This thin-client software reads and writes Access, dBase, and Paradox files, but the hook is that you can write applications that access NT or Win 95 servers with any Web browser. It provides a simple authoring environment that anyone with an understanding of macros can use to create multiuser, Internet-ready programs connected to a database, Netiva says. Written entirely in Java, this software makes database development look simple, according to the company. Data-Page, a patent-pending technology, eliminates CGI, HTML, and SQL by attaching an applet on the browser side that reads information from the server and feeds it to the user directly.



Contact: Netiva Software,
Campbell, CA, 408-379-2100;
http://www.netiva.com.
Enter 1080 on Inquiry Card.

Security

Battle Barbarians Behind the Gate

McAffee's Desktop Security Suite ($99) provides security behind a corporate firewall with modules for transparent network traffic encryption, file encryption, secure e-mail, desktop firewalls, backup, and virus protection. The package includes McAffee's NetCrypto 2.0 for network encryption, VirusScan 3.0, and PC Firewall 2.0, a desktop firewall for inbound and outbound access control.
Contact: McAffee,
Santa Clara, CA,
408-988-3832;
http://www.mcaffee.com.
Enter 1081 on Inquiry Card.

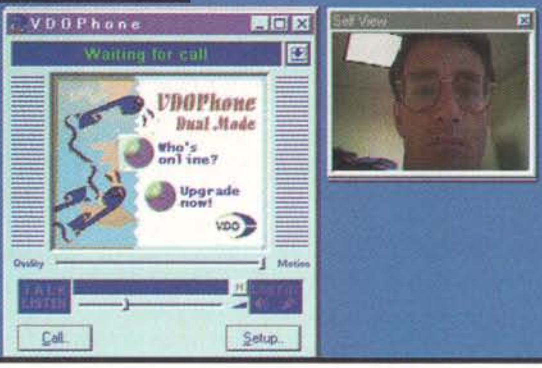
Messaging

Road Warriors' Personal Assistant

iPost universal messaging system ($24.95 per month) allows fax, voice, e-mail, and pager commu-

nications to be collected in one location and accessed through either phone or computer. Voice Profile for Internet Mail is technology that allows voice and fax to be accessed and read with any POP-3-compatible e-mail client through your PC or notebook. E-mail, fax, and voice can be accessed as GIF, TIF, TrueSpeech, GSM compressed, or RealAudio attachments to mail messages. All communications are routed to a single account and can be accessed by any of the above means.
Contact: IRdg, Winter Park, FL, 407-975-2900;
http://www.irdg.com.
Enter 1082 on Inquiry Card.

PREVIEW



VideoTalk
$299

Enter 1078 on Inquiry Card.

Hauppauge Digital
Hauppauge, NY
800-443-6284
516-434-1600
fax: 516-434-3198
http://www.hauppauge.com

Videoconferencing with an Assist

Hauppauge's new VideoTalk package combines videoconferencing software and a PCI card for improved audio and video performance. VideoTalk includes Microsoft's Netmeeting 2.0 and VDONet's VideoPhone 2.1, which let you hold videoconferences and whiteboard/application-sharing sessions over LANs, WANs, the plain old telephone system (POTS), ISDN, and the Internet. The package also supports video and frame capture.

The software gets hardware assistance from MediaSonic's iCom-H.32x PCI card. The card uses Analog Device's ADSP-2181 DSP to improve audio quality, supporting full duplex and echo cancellation even on low-end Pentiums (e.g., 66-MHz).

Thanks to the audio-processing boost, VideoTalk delivered better quality than software-only solutions I've tried using Pentium PCs to do point-to-point videoconferencing over POTS. Of course, today's new MMX processors and optimized software applications can deliver better videoconferencing over POTS and LANs than yesterday's PCs, but not everyone can pay the extra money to buy a new system. And VideoTalk's price ($299) includes the camera.

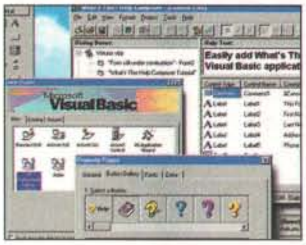
VideoTalk can deliver acceptable audio even in times of bandwidth constraint. I used VideoTalk in a POTS videoconference that went overseas via a modem connection that dropped to just 12 Kbps. At that speed, the video performance understandably suffered from pixelation and low frame rates, but the audio that came through the PC was slightly better in quality than a regular analog phone call.

I hope the final VideoTalk manuals are more useful than the documentation I received, which was at times less than explanatory (and I'm being charitable). Company officials tell me the documentation will get a much-needed sprucing up by release date. But for better videoconferencing using high-end or even low-end PC hardware, check out VideoTalk. **– Dave Andrews**

Programming

Help for Visual Basic Developers

THE WHAT'S THIS? HELP COMPOSER FROM Blue Sky Software ($499) provides an easy way to create and add context-sensitive Help buttons to any Visual C++ application. It is optimized for creating help files in Visual Basic and Visual Basic Pro 5.0. A "SmartHelp" ActiveX controller eliminates the need to write context-sensitive help. This tool can also make Microsoft Word into a hypertext authoring tool capable of making help files as easily as creating plain text, Blue Sky says.
Contact: Blue Sky, La Jolla, CA, 619-459-6365;
http://www.blue-sky.com.
Enter 1086 on Inquiry Card.



A Free Java Platform

OBJECT SPACE INTRODUCES VOYAGER, A development platform for agent-enhanced distributed computing in Java. This software seamlessly supports both traditional and agent-enhanced distributed techniques to create network applications for a variety of equipment ranging from desktop computers to embedded systems. Voyager will be introduced as a free product for commercial use.
Contact: ObjectSpace, Dallas, TX, 214-934-2496;
http://www.objectspace.com.
Enter 1084 on Inquiry Card.

Manage Objects in Java

THE POET UNIVERSAL OBJECT SERVER ($495 for a development kit; $998 for server) is an object database management system for handling persistent objects in Java. Like Java, POET supports an object-oriented approach to programming, helping developers avoid writing code for mapping object models. Java objects are automatically transferred into the POET database without additional coding. POET offers multiuser/concurrent access, client/server multitier architecture, leverage of SMP servers and DBA tools for flexibility, scalability, and reliability, the company says. The POET Java Software Development Kit is a set of class libraries and tools to work with the Universal Object Server to provide transparent persistence capabilities for Java objects.
Contact: POET Software, San Mateo, CA, 800-950-8845 or 415-286-4640;
info@poet.com;
http://www.poet.com.
Enter 1085 on Inquiry Card.

Video

Easy Effects and Editing

VIDEOTROPE ($49) IS A VIDEO EDITING TOOL that lets you edit, create, and apply effects to video clips. Videotrope breaks video down into still frames and allows you to cut and paste sound and images, insert new frames, add titles, and apply overlays and underlays for adding background to blue-screen animations and to insert new soundtracks. It supports AVI, BMP, FLI, FLC, TGA, and WAV formats.
Contact: Jasc,
Eden Prairie, MN,

800-622-2793 or 612-930-9800; sales@jasc.com; http://www.jasc.com.
Enter 1088 on Inquiry Card.

Dynamic Hyperlinks

TAKING MULTIMEDIA HYPERLINKS TO THE next interactive level, Ephyx Technologies offers V-Active ($695), software that works within multimedia authoring environments to create hyperlinks that move with an object. Should you want a hyperlink attached to an object like a race car moving across a screen, you can place one that follows the car as it moves past. Algorithms analyze an object's motion through complex movements, even if the camera angle or point of view changes, allowing the user to click on a highlighted moving image and link to another video or image file. V-Active supports standard video formats like AVI, QuickTime, and MPEG.
Contact: Ephyx, San Francisco, CA, 415-439-8380; info@ephyx.com; http://www.ephyx.com.
Enter 1087 on Inquiry Card.

Software Updates

Suite Software rereleases its Object Request Broker, now fully compliant with CORBA 2.0. The product is called **SuiteValet** and has integrated asynchronous messaging services and integrated security services. SuiteValet is priced at $195, or $500 to $3195 with graphic manager interface and scripting language, depending on the platform. The new release brings the ORB into compliance with industry standards, which had not been formalized when Suite Valet was initially released. It allows for the building of large production applications to be run across distributed, heterogeneous systems. SuiteValet operates with most open platforms, including Windows, NT, Unix, Open VMS, and Next.
Contact: Suite Software, Anaheim, CA, 714-938-8850; http://www.suite.com.
Enter 1093 on Inquiry Card.

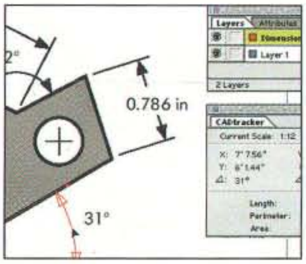
Oracle Human Resources offers a suite of products and kiosks designed specifically for workers and HR managers. The newest release, 10.7, offers 35 applications for HR and finance department needs, many Web-enabled. Managers have access to hiring, relocation, or assessment information, while employees have access to their own files. Oracle's software is designed with standard interfaces but can be customized.
Contact: Oracle, Redwood Shores, CA, 415-506-7000; http://www.oracle.com.
Enter 1094 on Inquiry Card.

Attachmate's **KEA! X 3.0** ($99) is the next generation of PC X servers for the Windows market. KEA! X provides both 16- and 32-bit products, allowing companies to migrate to Windows 95 and NT at their own pace without the expense of managing platform-specific licenses. It provides access to X Window-based applications from any Windows 3.x, Win 95, or NT desktop. Attachmate combines a PC X server with a TCP/IP stack and full-featured VT420 emulator. KEA! X 3.0 supports X11R6, the latest standard X spec, and is designed for ease of use and manageability, particularly in installation, the company says.
Contact: Attachmate, Bellevue, WA, 800-426-6283 or 206-644-4010; http://www.attachmate.com.
Enter 1095 on Inquiry Card.

CAD

More Punch for Illustrator

HOT DOOR'S CADTOOLS 1.0 ($129) makes Adobe Illustrator more functional with new plug-in drafting and dimension tools. The 33 add-ins include help programs, scale and object measurement palettes, and tools for drawing complex shapes. It is available for Windows 95, NT 4.0, and Macintosh 68K or Power Macintosh.



Contact: Hot Door, Long Beach, CA, 562-438-0377; http://www.hotdoor.com.
Enter 1083 on Inquiry Card.

Networking

Managing the Network Edge

XYPLEX NETWORKS' EDGEBLASTER OFFERS a WAN solution for managing that nebulous network edge where enterprise network meets public network. Edgeblaster costs $6000 to $8000, which includes a four-port single T1/E1 and PRI card as well as 48 digital modems. Pricing goes up depending on the configuration. With an open, modular architecture, Edgeblaster integrates switching, routing, access serving, and digital modem capabilities to provide seamless links between remote users, enterprise networks, and branch offices. The graphical interface is entirely based in HTML, eliminating command-line interfaces and reducing configuration and installation costs, Xyplex says. Edgeblaster offers optional firewall modules for added security.
Contact: Xyplex Networks, Littleton, MA, 508-952-470; http://www.xyplex.com.
Enter 1091 on Inquiry Card.

The Web

Group Surfing

YOUR BOOKMARK PAGE NEED NOT BE A LONELY jumble of URLs. Hitachi's Zoo-Works Research for Teams ($795) automatically generates and manages a shared pool of information gathered on-line, eliminating redundancy in searches and allowing users to add comments or suggestions to the indexed pages. Up to 50 teammates can index URLs and full texts of every Web page members visit into a searchable, network-accessible library. ZooWorks requires Win 95 or NT servers, 10 MB of hard disk space, 32 MB of RAM, and 133-MHz Pentium processor.
Contact: Hitachi Computer Products (America), Santa Clara, CA, 408-986-9770; http://www.hitachi.com/research.
Enter 1092 on Inquiry Card.

Connectivity

Easy Routing

ROUTING BUSINESS DOCUMENTS ACROSS LANs and WANs with Isocor's SmartRouter ($2000-3000) software means high rates of data transfer without loss of message integrity, the company says. This plug-and-play solution offers a modular design that can expand as a company grows. It provides remote management and administration capabilities from one location, reducing the complexity of managing a distributed messaging backbone. The software is Windows NT-based and optimized for Pentium Pro processors.
Contact: Isocor, Santa Monica, CA, 310-581-8100; info@isocor.com; http://www.isocor.com.
Enter 1090 on Inquiry Card.

improbable

Revenge on junk e-mailers, Part 2. Also, bandwidth-crunch exacerbation.

Advances and Retreats in Computing

Dead-Letter Office

Last month we promised to describe our new assassination bureau. Also known informally as the Dead Letter Office, it grew out of Project Whacko, our campaign to help junk e-mailers whack themselves out of existence. For obvious reasons, the organization will remain shadowy. Its name, and those of its members, will be disguised in our reports. Let us call it, somewhat formally, the Department of Public Works, or DPW. The DPW will dispose of trash—junk e-mailers, to be specific.

The DPW's chief task is to investigate and identify who actually sends junk mail. Junk e-mailers often disguise their work (thus misdirecting their victims' ire against some innocent party). Generally this takes the form of forged e-mail addresses and telephone numbers. The most crucial—and painstaking—step in stopping a junk e-mailer is to find him or her. This requires superior technological and detective skills.

The DPW is good at this. Only the best hackers have been invited to join the DPW. None of its members will publicly acknowledge a connection with the DPW, but no doubt you can guess who some of the involved individuals are. If you thank one for his or her presumed participation with the DPW, expect exactly a wink and a nod—but no more—in reply.

The DPW has been extremely busy. Most of its work must remain, in the tradition of good code everywhere, undocumented. But public confidence in the project must be upheld. Therefore, we will present heavily disguised examples of the agency's work. Below is the first one....

Assassination Bureau Case File #32

DPW received junk message that began as follows:

IMAGINE WHAT YOU CAN DO WITH...
UP TO $800.00 A WEEK EXTRA INCOME!
HERE'S HOW TO GET STARTED

HEADER CONTAINED PHONY AOL ADDRESS. Instructions for removing self from list gave .NL address, which DPW agents identified as auto-response lunch menu for sandwich shop in Amsterdam. Agents visited sandwich shop; had lunch. Sandwich shop unaware spammer using its address in vain.

AGENTS RETURNED HOME. "Call this" telephone number in original message led agents to call-forwarding station in Cupertino. Calls auto-switched to number in Reno, Nevada. Agents traced Reno phone number to 1952 trailer owned, according to county records, by "Henry."

AGENTS VISITED TRAILER, disguised as themselves. "Henry" offered agents jobs as telephone clerks at $3.75 per hour. Agents entered "Henry's" facility, observed six telephones, nine cartons overflowing with credit-card statements and uncashed checks, six crates of Alpo dog food, and set of *TV Guide* back issues.

AGENTS TERMINATED "HENRY'S" CONNECTION: deposited body with local ISP. Investigation showed ISP owned by brother-in-law of late "Henry." Agents rendered ISP provider dev/null.

CASE DISPOSITION: Closed.

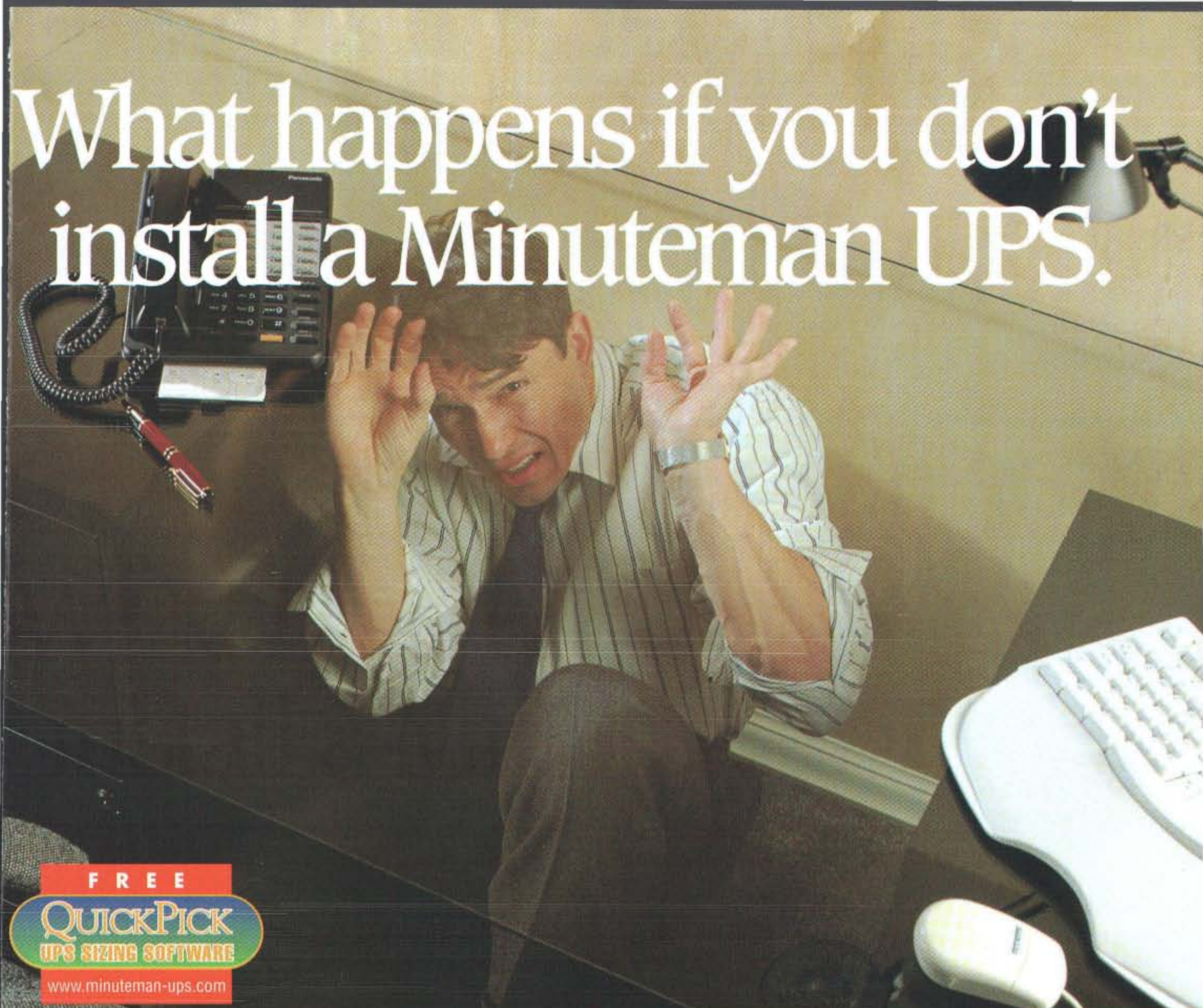
BANDWIDTH BLOT

The current telephone infrastructure was designed to handle calls averaging 6 minutes in duration. But the proliferation of fax machines, dial-up computer links, and phone-sex services is straining the system in ways that were undreamed of in the original system-design philosophy. Many engineering teams are working on new designs for the phone system.

One team, which shall be unidentified here other than to say it's in western Pennsylvania, is trying to spur things to a head by staging a TeleComplexity Competition. The "winner" will be the one who most effectively ties up the largest share of communications resources (including, but not limited to, the phone system and the Internet) with the smallest amount of code.

Marc Abrahams is the editor of the Annals of Improbable Research. *You can contact him by sending e-mail to* **marca@improb .com.**

ILLUSTRATION: VICTOR GAD © 1997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